Our subscribers are requested to note the expiration date that appears on the wrapper in which they receive their copies of SCIENTIFIC AMERICAN. If they will send in their renewal orders at least two weeks prior to the date of expiration, it will aid us greatly in rendering them efficient service.

GENERAL LIBRARY
DEC 30 1918

NOTICE TO READER
When you finish reading this magazine, place a one cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas. NO WRAPPING, NO ADDRESS.
A. S. Burleson, Postmaster General.

SCIENTIFIC AMERICAN

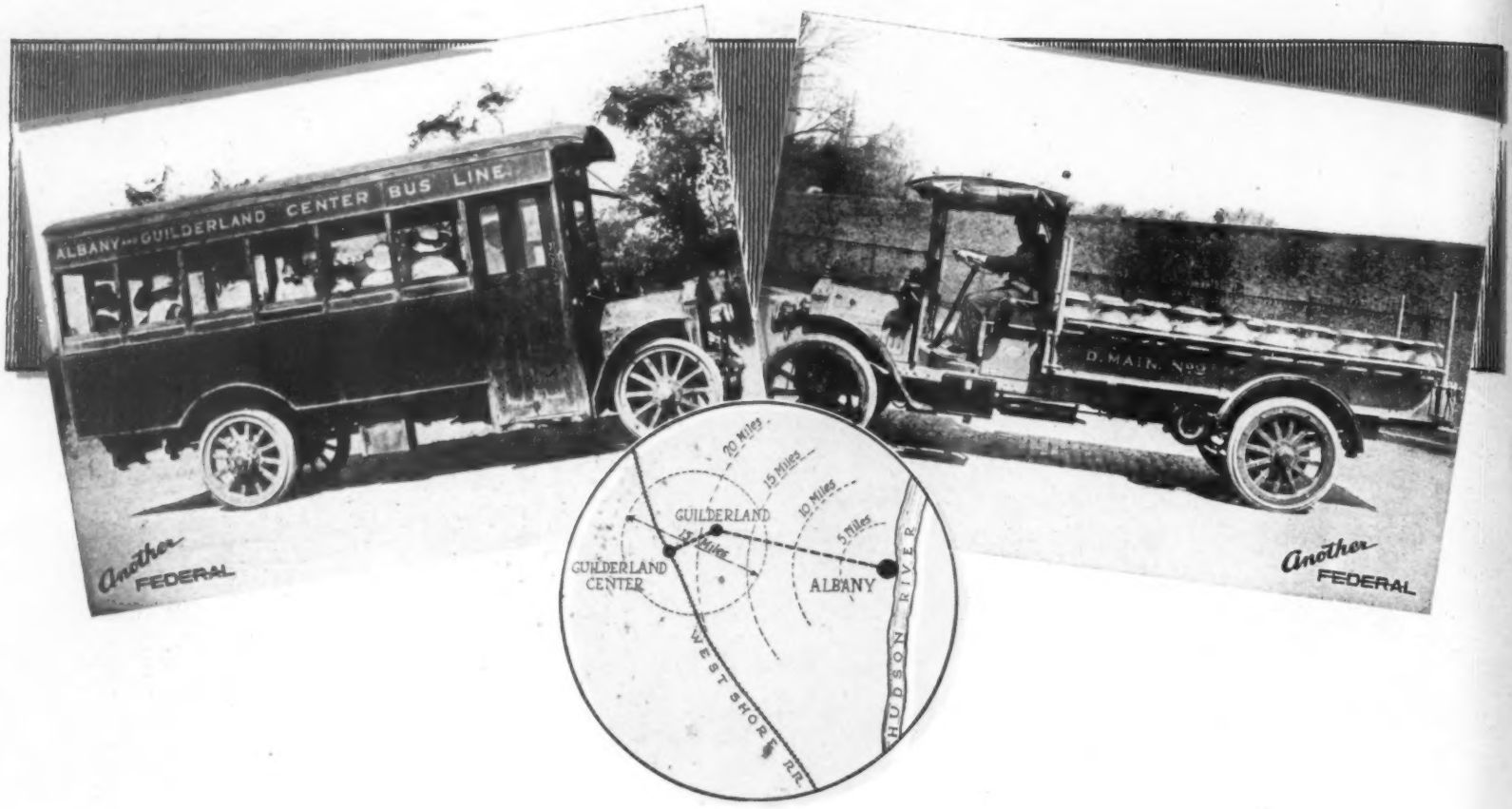
Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

KEEPING THE HIGHWAYS CLEAR IN WINTER TIME [See page 514]

Vol. CXIX. No. 26
December 28, 1918

Published Weekly by
Munn & Co., Inc., New York, N. Y.

Price 10 Cents
$5.00 a Year



For Five Years These Federals Have Demonstrated the Value of Rural Motor Express

With the interest of the nation centered on the better transportation and the possibilities of Rural Motor Express, the success of this five year old Federal line is highly significant.

Guilderland, New York, is in the center of a good dairy section, but was handicapped by inconvenient means of marketing the products of the big dairy farms.

To reach Albany, the logical market, passengers and freight had to go to Guilderland Center. From that point the trip to Albany requires a three hour run.

Dewitt C. Main of Guilderland realized this situation. He had been trying to haul milk direct to Albany with horses. He found it hard going, being unable to get to Albany before noon. Each trip was an all day trip. In summer, much of the milk spoiled on the way.

So finally Mr. Main turned to the Federal. His first truck was utilized solely in carrying milk. The result was so gratifying that other trucks were added. Today there are four Federals at work, two of which are carrying milk, and two being used for passenger service.

Over a million quarts of milk are carried into Albany each year by Main's Federals. Milk production in that district has increased from 200 to 700 quarts per day. Where three hours formerly was required to ship the milk by train to Albany Main's Federals are doing it in less than an hour.

Over 36,000 passengers are carried annually by the Federals used as passenger buses.

On the return trips Mr. Main finds that he is able to carry 75% of capacity loads in supplying the farms of the Guilderland district with merchandise.

The Federals hauling milk have not missed a single day in five years. This is Federal consistency, which is the important feature to demand in selecting trucks for such service.

This story emphasizes the usual satisfaction that Federals give. Federal stamina, ruggedness and durability are features which apply to the greatest advantage in the solving of any transportation problem.

Federal Motor Truck Company, Detroit, Michigan

Capacities—One to Five Tons *"Return Loads Will Cut Your Haulage Costs"*

FEDERAL

A Line of Tires to Meet—Exactly —Any Possible Need

It is safe to say that the national sales and service organization back of United States Tires is easily the biggest and most comprehensive of any one tire manufacturer.

During the past year over 18,000 United States Tire Sales and Service Depots, were operated by dealers whose good business judgment taught them the value of the United States Tire Sales and Service Depot Agreement.

You can easily understand why a line of five tires—all good tires—is so valuable an asset to a dealer.

It puts him in the enviable position of being able to meet any possible demand. It enables him to furnish good tires to meet—and meet exactly—the individual requirements of any customer that enters his shop.

The United States line includes the famous 'Royal Cord,' considered by tens of thousands the finest tire built. Also the 'Nobby,' 'Chain,' 'Usco' and 'Plain.'

In addition to the five for passenger and light delivery cars there are also two for trucks—the 'Nobby Cord' pneumatic and the Solid Truck Tire.

Why not write to our nearest branch for information on our Sales and Service Depot agreement?

United States Tires are Good Tires

America has learned a valuable transportation lesson.

War conditions have taught us that the facilities of our railroads *can* be taxed beyond capacity. Depending solely on railroads for the transportation of merchandise resulted in congested freight yards and clogged lines. These created chaotic conditions—practically paralyzed business.

At the very crisis of the situation MACK Trucks conclusively demonstrated that their power, strength, endurance and ease and economy of operation afforded a dependable means of independent transportation heretofore thought impractical.

On Saturday, December 29, 1917, the Goodyear Tire and Rubber Company started a 3½ ton MACK Truck from New York City for Akron, Ohio. The run of 504 miles, in 15 degrees-below-zero weather, through snow, was made in 61 hours! (The railroad freight schedule is about 108 hours.)

This noteworthy performance helped the country to revise its estimate of the motor truck's range of usefulness. And now the same MACK Truck is operating on regular schedule between Akron, Ohio, and Boston, Massachusetts.

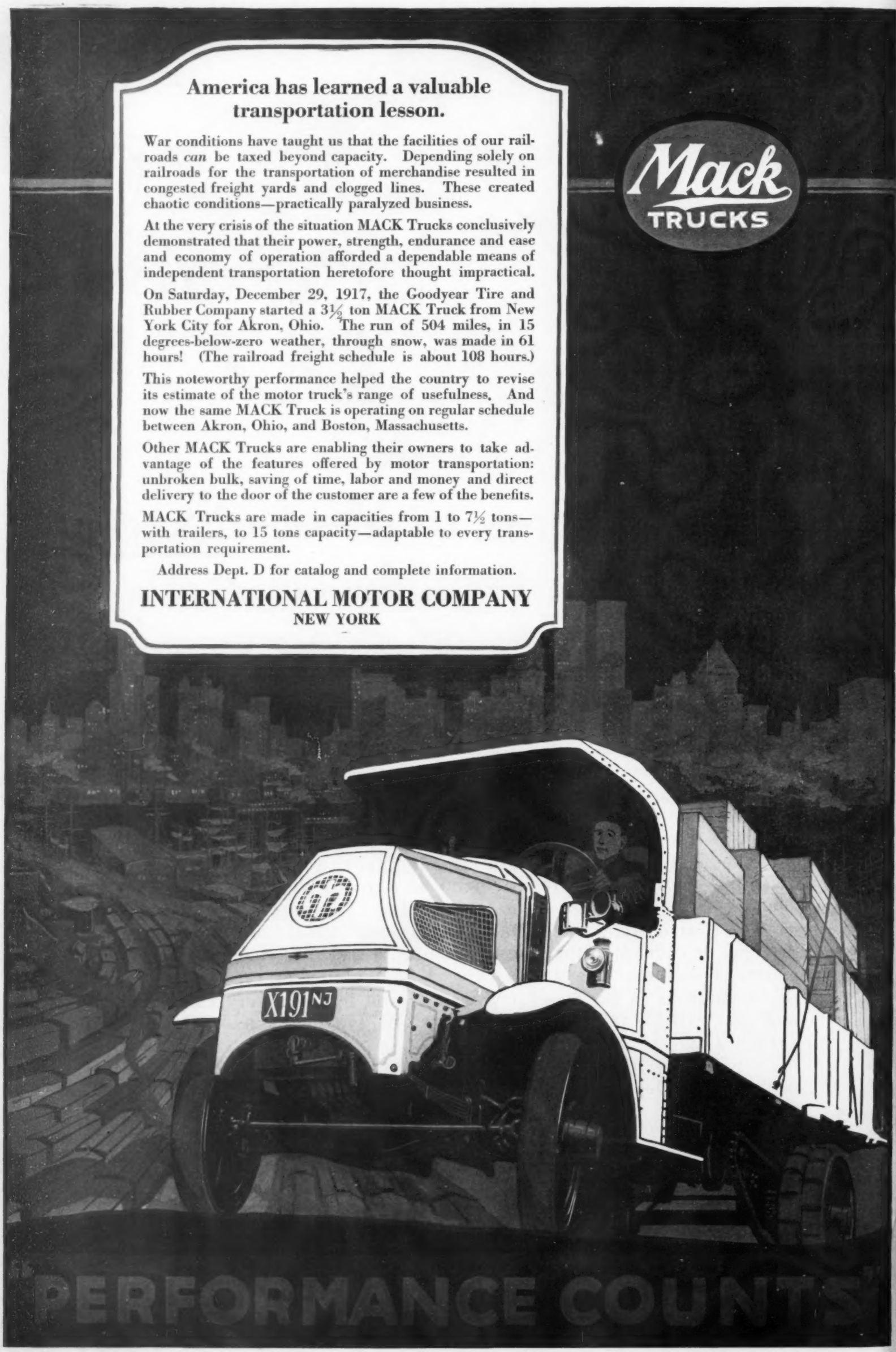
Other MACK Trucks are enabling their owners to take advantage of the features offered by motor transportation: unbroken bulk, saving of time, labor and money and direct delivery to the door of the customer are a few of the benefits.

MACK Trucks are made in capacities from 1 to 7½ tons—with trailers, to 15 tons capacity—adaptable to every transportation requirement.

Address Dept. D for catalog and complete information.

INTERNATIONAL MOTOR COMPANY
NEW YORK

Mack TRUCKS



SEVENTY-FOURTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIX. NUMBER 26] NEW YORK, DECEMBER 28, 1918 [10 CENTS A COPY $5.00 A YEAR

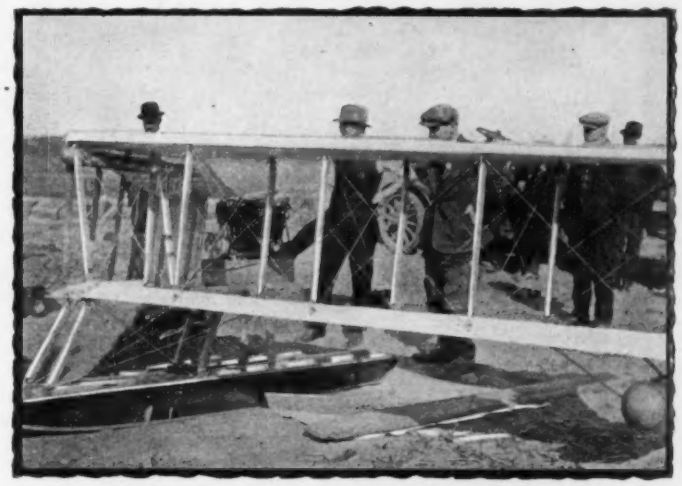
An Airplane Built To Be Shot Down

UNTIL quite recently, the usual way for a machine gunner to train for his pleasant task of bringing down Boche airplanes has been to blaze away at captive balloons. At best, this has been tame sport. Another way has been to use the so-called camera gun, which records the "hits" on a film or plate; but the main objection to this procedure is that a substitute is used for the gun, and that the "hits" cannot be determined until the negative is developed some time later. It has remained for an American aircraft builder to introduce a diminutive airplane which flies itself without the aid of any human hand to guide it, and which can therefore be used as a target, thus bringing realism and efficiency to the aerial gunnery schools.

The target airplane is of the Burgess-Dunne type, modified to meet the conditions for which it was designed. Inherent stability is obtained by employing a large sweepback and negative dihedral angle. The course of the machine is governed by setting and locking the control surfaces in position prior to flight. The duration of flight may be governed by limiting the fuel supply or by employing an automatic timing device to control the throttle. By the proper setting of the controls, the machine can be made to fly in a spiral path until its fuel is exhausted, whereupon it will assume its natural gliding angle and land approximately at its starting point. This fact makes it an easy matter to recover the machine after a flight, if it has not been shot down before exhausting its fuel.

The little machine is of the seaplane design, to facilitate starting and alighting. It has a span of 18 feet 5 inches. The cord is only 28 inches. The length is 9 feet, while the over-all height is 4 feet 8 inches. Although the weight of the complete machine is only 175 pounds, it is capable of carrying a man. The power plant consists of a 12-horse-power, four-cylinder motorcycle engine, which has been rebuilt to meet the special requirements. The engine drives a 42-inch propeller, since the machine is of the "pusher" category. While climbing, the diminutive airplane develops a speed of 40 miles per hour, which rises to 50 when flying on a level keel.

Firing at the target airplane, the aerial-gunnery students get excellent practice. They use actual machine guns firing actual cartridges, and operate under conditions pretty close to actual aerial combat. It is not to be supposed that the target airplane is shot down on its initial flight; in fact, its life is considerable because of the difficulty of scoring a vital hit. Most shots merely perforate the wings or chip the structural members, and a few minutes' overhauling soon prepares the target machine for further flights.



Side view of the target seaplane, showing the pronounced sweepback of the planes

Copyright, Munn & Co., Inc.

Weighing but 175 pounds and propelled by a 12-horse-power motorcycle engine, this diminutive seaplane is employed as a flying target at aerial gunnery schools

Baby Chicks by Parcel Post

HERETOFORE it has been the custom for those who wished to raise chickens to buy the eggs, and hatch them for themselves. The procedure is now being reversed, however; more and more the hatching is done by the producer of the eggs, who, instead of shipping the latter, ships the baby chicks. America's biggest hatchery, located at Cleveland, holds as many as 660,000 eggs at a time, and in a single season hatches 2,000,000 chicks. The baby chicks are shipped, by express or parcel post, anywhere within 72 hours rail journey; and 98 per cent of them arrive safely. The 10 cent stores in many towns handle the baby chicks; and in fact, the "day-old" is fast overturning conditions in the poultry industry.

It may at first thought seem surprising to be told that a baby chick stands shipment better than an egg. The fact seems to be that hurried express handlers have no particular respect for eggs, but that subconsciously they grow careful when they hear the "peep, peep" of the chicks. It should also be born in mind that an egg weighs as much as a chick, and must be carefully packed in excelsior, wood wool, or some similar material, while an order of baby chicks can be assembled in a corrugated paper box in a minute or two, and when ready for shipment will weigh less and therefore cost less than an equal number of eggs.

Another angle is the economy of hatching all the chicks in one place. There is a smaller percentage of failing eggs, a smaller percentage of chicks that die, a smaller number of destructive incubator accidents, and a tremendous economy in fuel. In fact, so marked is the last-named feature that the Fuel Administration has guaranteed the fuel supply of the hatcheries; while of course the individual hatcher must take his chances with everybody else. So on all grounds, it is after all not surprising that the chick is rapidly displacing the egg in the mail-order poultry industry.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, December 28, 1918

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1918 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Commanding Naval Position of the United States

FOR several years preceding the war this journal carried on an earnest propaganda for the upbuilding of our navy, until it should regain its proper rank as the second naval power of the world —a position which we had gained in 1904, and subsequently, thanks to neglect, had lost to Germany.

The war has come and gone; and, with its passing has passed also the naval power of Germany. Automatically, the United States navy moves up to second place.

But not only have the stupendous naval operations of the war, extending over four and one-half years, removed Germany from second place, but the naval losses of our Allies in capital ships have had the result of making our navy so strong a second, that there is practically no third—as the following analysis of the situation will clearly show.

In a well-balanced navy (which ours at present is not, though it shortly will be) with a proper relative proportion of battleships, battle-cruisers, scouts and destroyers, the test of its strength is in the number and quality of its capital or first-line ships. For whether a naval war be long or short the final issue will be decided only when the great ships which "lie in the line," range themselves in column, fleet against fleet, to fight it out to the death.

Judged on the basis of fighting-line strength, we arrive at the unexpected and very gratifying discovery that, today, the United States navy is not only second in strength, but is actually equal in material strength to the next three first-class navies, namely, those of Japan, France, and Italy, combined. As a matter of fact, because it is a homogeneous unit, with a common language, common discipline, common equipment, and flies a common battleflag, it is militarily by that much stronger and more efficient.

In making the following comparison, no ships are included which mount any guns in their main or all-big-gun batteries of less than twelve-inch caliber, and no count is taken of the armor and the displacement.

The United States, according to a statement of Rear-Admiral Taylor, possesses 19 dreadnoughts. It is known that Japan has 9, France 7, and Italy 5. This means that we have three more capital ships than Japan and France, five more than Japan and Italy, seven more than France and Italy, and only two less than all three navies combined.

But because of the preponderance of the 14-inch gun in our later ships, the weight of the total broadside of our 19 capital ships is about the same as that of the 21 ships of our three allies, the aggregate weight of metal being 245,000 pounds for our ships to 248,000 pounds for those of Japan, France and Italy.

There are other considerations, such as the thickness of the armor protection and the displacement of the ships, which give our later ships a positive preponderance of strength. For the armor protection is about 30 per cent heavier, and the average displacement of our individual super-dreadnoughts (a most important consideration) is about 32,000 tons as against 24,750 tons; an advantage of about 30 per cent.

This comparison says nothing of destroyers, in which we are strong, or of battle-cruisers and scouts, of which we have none. If we lay down five of the ten battleships, together with the six battle-cruisers, of the 1916 program, and double the number of 7,000-ton scouts to twenty, we shall have 30 dreadnoughts for the first line, and our navy will be well rounded out. Thereafter, in common with our allies, we should build yearly, on a continuing program, sufficient ships to make good the depreciation of earlier ships through age.

That is a program both sane and legitimate. It finds the United States in the position to which the so-called "big-navy" men have wished to see it lifted for many years past. Moreover, we hold second place with such a prepondrance of power, that there can never be any threat of our losing it—provided, always provided, that we make the modest additions each year that will be sufficient to maintain our international rating.

In 1914, although the German war-cloud was rolling westward to our shores, the President deprecated any great enlargement of the United States navy on the ground that it would provoke uneasiness and distrust among the other nations.

Today, although that war-cloud is gone and the sky is clear, and in spite of the fact that our navy has reached its goal and is stronger than the next three navies combined, Mr. Daniels would have us more than triple its strength, at a cost to the taxpayers of several billion dollars, and at the cost, also, of arousing that "uneasiness and distrust" against which the President, his chief, so eloquently warned us in 1914.

Many of his best friends, ourselves included, are asking themselves what it can be that is troubling our genial Secretary. Has some war microbe, old or new, got into his system, and, if so, what is it and how shall it be got out? There was a time when he was wont to warn us in appealing sentences against "bloated armaments." Can it be that he himself has fallen a victim to the "*bacillus militaristicus*."

What Kind of Revenue Bill?

GERMANY'S development in peace and her powers of resistance in war were in large measure due to her way of dealing with problems of public policy. She recognized that such problems, when handled by a large body of laymen, become inevitably the football of emotions and politics. So she consistently turned them over for study and report to those best qualified by training and experience to handle them; and she made a business of respecting and following the opinions thus obtained.

We in America, on the other hand, cannot seem to get away from the idea that on matters of public policy anybody can reach as effective a conclusion as anybody else, regardless of experience or informedness. We are coming to give more respect to specialists in such tangible fields as chemistry and engineering; but upon their colleagues in more abstract lines we still look with derision and contempt. What does an expert know, anyhow, that a plain citizen can't improve upon with the aid of a little common sense?—this seems to be the attitude of the day.

A striking instance of this was presented, a year ago, in the Congressional proceedings out of which the 1918 tax law sprang. The House and Senate Committees in charge gave weeks and months to the most exhaustive consideration, putting themselves in touch with expert knowledge in every detail, evolving carefully-drawn and well-balanced bills. These the House and the Senate promptly tore to pieces.

Amendment after amendment was offered and accepted on the floor. In each house the measure, in its nature intricate, with every part dependent on every other, was altered upon the motion of any member who could enlist a sufficient following or a sufficient number of log-rollers to stamp his notions upon the bill, regardless of how little he might know about taxation or business. The two bills thus evolved as the result of extemporaneous dilettantism went into conference; and a third and wholly different measure emerged, bearing, if anything, even more evidence than its predecessors of insufficient thought, inadequate knowledge, makeshift compromises and sectional prejudice in dealing with a matter of the utmost technical complexity and national import.

With little of discussion and less of effective scrutiny this measure was railroaded through a now-only-too-willing Congress. Bristling with inconsistencies, many of its details are so intricate, many of its definitions so obscure, many of its provisions so unworkable, that to this day they have not been unravelled. Is it not a ridiculous state of affairs that we should have a tax law under which it is possible for three competent lawyers to arrive at three different opinions as to the amount of tax due from a given individual. Is it not an impossible situation when the collecting agency is delayed for weeks in putting out the forms because it cannot decide how to get the information which the law necessitates that it have—when an eminent attorney resigns as counsel for a corporation rather than wrestle with the problem of its excess profits return?

Congress this year seems to have learned, at least in some measure, the lesson of last year. It displays a decided tendency to listen to what those who know can tell it. Is it too much to hope that it will maintain this state of mind to the end of the debate on the Revenue Bill? If it does, we may well hope for as good a bill as our present system of legislation will permit.

Even that, though something, will be little enough. The Congressional methods of transacting public business are the most glaring anachronism of the age. Ours is the only great country in which no budget system prevails, in which appropriations for every purpose are left at the mercy of individuals and of unrelated groups all striving for personal or local advantage. We are the only nation of the first rank in which priority of legislative business is determined by no competent authority, in which there is no check upon the flood of small measures introduced by small members for small purposes, in which the ability of such members to obstruct the legislative machinery is considered a sacred right of the legislator, in which there is no competent bureau to see that all bills are properly drafted in the first place. Under the circumstances, it is perhaps too much to ask that Congress evolve a really first-class revenue bill. If it will but lay aside its prejudice against listening to the man who knows what he is talking about, it will have made a sufficient advance for one year—the matter of putting Congress itself under the auspices of experts in legislation may well go over.

The Wireless Situation

THE days of peace to which all wireless men, professional, commercial and amateur, alike, had been looking forward during the past years of war and restriction, are again with us. But they are not the old days of peace for wireless; for at the moment when commercial and amateur operators have been planning to resume their work on a peace basis, they are confronted with a Government monopoly of the ether.

Many reasons have been advanced for this latest Government move. The old excuse of interference is again put forth by the officials, although in almost the same breath, we have been told of the relative perfection of Naval and Army wireless stations to a degree where interference is practically eliminated. Another reason is international obligations, which, strange to say, did not seem to be impaired when commercial and amateur stations operated under the regulations introduced in 1912 and in effect until the war. The remaining reasons are just as unconvincing.

Viewed from the other side of the question, the proposed Naval monopoly of wireless should not be permitted to become a *fait accompli* for many good and sufficient reasons. First, such a measure would exclude the general public from any share in the benefits of this new science, which may still come to rival the telephone in everyday usefulness. Further progress would be sadly checked, if not stopped altogether. The provisions for experimental stations, contained in Bill H. R. 13159 by Mr. Alexander, are absolutely futile. What inventor would bother inventing something for which there was no call and no market?

The Naval control of wireless dooms the amateur once and for all, so it seems. It would be difficult to find an instance of more gross ingratitude. For was it not the wireless amateur who came forth in vast numbers to supply the demands of the Navy and Army for radio operators at the beginning of the war? When one considers the difficulties and delays experienced by other navies and armies in finding suitable young men and training them for radio work, one arrives at the obvious conclusion that such benefit to the nation far outweighs any trifling interference.

Liberality of operating conditions is needed to furnish sufficient stimulus to make a man learn radio and erect a station. Operating conditions cannot be restricted much more than at present, and still leave any incentive to progress. It has long been pointed out that amateur wireless has exerted the best influence on our young men, developing the electrical and engineering traits in many of them.

Government monopoly would destroy the great field which is open to radio communication in the rural communities, especially in the matter of Government time and weather services. In this connection, too, stations for receiving purposes only, should not be interfered with as proposed in Mr. Alexander's bill. What jeweler would install a time signal receiving set if he had to go somewhere and pass a Government examination before being permitted to operate the set?

There is no need for regulating the receiving of signals. Radio secrecy is impossible except by putting messages in code, and that would be done in any case. Besides, the regulations of 1912 provide due punishment for anyone who reveals the contents of radio messages, whether such person is licensed or not. The licensing of receiving stations can only mean a useless expense and more details for the Government.

The Act would deliberately confiscate the business of a number of commercial companies and manufacturers, destroying their industry and throwing their employees out of work, as well as depriving hundreds of thousands of citizens of the right to use their wireless apparatus.

If public opinion counts for something in the consideration of the bill, it will be well for the legislature to remember that the act would engender a persistent feeling of resentment among the young men who have been deprived of their wireless stations at the actual moment of serving their country. The amateurs know full well that there can be no question of interference, so long as the present law is strictly enforced, and the Navy keeps to its own wave lengths. They also feel that the bill is despotic and un-American in character; and they believe that the present law is adequate.

Aeronautical

Our Army of Fliers.—In his recent annual report Major-Gen. William L. Kenley, director of military aeronautics, states that 4,980 men had been graduated as reserve military aviators, the first rating for pilots, by June 30th, last, with 110 bombers, 85 bombing pilots, 464 observers, 389 observer pilots, and 131 pursuit pilots. In the year ended last June 30th, there were 152 fatalities in training, or an average of one death to 2,684 hours and 201,000 miles flown. Stalled engines, usually due to an error of the pilot, caused 86 deaths; collisions, 30; and sideslips, 10. The report goes on further to state that 440 balloon officers also had been graduated, 155 of whom were fully qualified observers during the year.

Our War in the Air.—When hostilities were suspended American aviators had destroyed 661 more German airplanes and 35 more German balloons than the Americans had lost. The number of enemy airplanes destroyed by the Americans was 926, and the numebr of balloons 73, continues a recent *Associated Press* dispatch. Two hundred and sixty-five American airplanes and 38 balloons were destroyed by the enemy. On November 11th, the day of the signing of the armistice, there were actually engaged on the front 740 American airplanes, 744 pilots, 457 observers, and 23 aerial gunners. Of the machines, 329 were of the pursuit type, 296 were for observation and 115 were bombers. Between September 12th and November 11th the air forces operating with the First Army dropped about 120 tons of high explosive on the enemy lines and supply depots and railheads. Figures concerning America's share on other parts of the front have not yet been divulged.

A Remarkable Zeppelin Flight.—From Germany now comes a startling story of the trip of a Zeppelin in November, 1917, which is of considerable interest despite the fact that it is over a year old. It appears that a Zeppelin started from Bulgaria for East Africa with 22 tons of munitions and medicines and a crew of 22. It had arrived over Khartoum, in the Sudan, when it was ordered by wireless to return because it was learned that the bulk of the forces of General von Lettow Vorbeck, the German commander in East Africa, had surrendered. It returned to its starting point four days after it had left. The Germans claim that this airship could have made a round trip between Berlin and New York, without stopping. It is also learned that the Zeppelin factory at Friedrichshafen is building an airship for transatlantic traffic, capable of carrying 100 passengers. It has nine engines and eight propellers. If the international situation clears up by next summer, the first flight will probably be made in July. The flight is expected to be made in 40 hours.

A Decoy Airplane.—Two British aviators, at great personal risk, enabled a successful local raid to be made with hardly a single casualty to the attacking British, according to the *Daily Chronicle*. It had become necessary to take a small salient in the line. The Germans were expecting an ordinary attack, with its preliminary bombardment. Early in the morning a British airplane passed very low over the front trenches and purposely flew slowly parallel to the German line, but about five or six hundred yards behind it. The Germans thought this a target not to be missed, and unsuspectingly fell into the trap set for them, by turning their backs to the British trenches in order to fire on the machine. While they were thus busily engaging the airplane, the British infantry leaped from their trenches and captured in a few minutes a position to which considerable importance was attached by the British Staff, incidentally taking quite a number of prisoners. The airplane returned to its airdrome, riddled with bullet holes, but fortunately, both the pilot and the observer were unscathed.

Dangerous Work.—Many people both in France and England have repeatedly asked what has become of Jules Vedrines, France's most famous aviator before the war, of whom nothing whatever has been heard since the early days of the war when he bombarded Metz. The *Petit Journal* recently raised the veil and proved Vedrines to be a great hero, who has undertaken many perilous aerial journeys into Germany. He has piloted many men into enemy territory and spent various periods in gaining invaluable information and in destroying important places by means of bombs. The enemy has imitated the French, and has done the same thing recently. Hence the recent warning published in Germany instructing civilians to give instant information of the landing of suspected aviators. In less than four months Vedrines made seven journeys, on two occasions going to fetch his passengers at an agreed place. Vedrines knew perfectly well that if he were caught he would be shot, but he always volunteered for these dangerous missions. He has been awarded the Legion of Honor, the Military Medal, and several brilliant citations in army orders. It is also revealed that Guynemer and Ballard were also concerned in this work from time to time.

Science

New Studies of the Mound Builders' Country.—Dr. Clark Wissler, of the American Museum of Natural History, spent part of last summer making a reconnaissance of southeastern Indiana for the purpose of determining how far west the Ohio mound area extends. His data will supplement the full and accurate map of mounds and earthworks in Ohio prepared by Dr. W. T. Mills, state archæologist. Several new sites were located, for further exploration by the Museum.

Medical Entomology.—In connection with war problems, the Bureau of Entomology, in Washington, has been conducting a class in the entomology of disease, hygiene and sanitation. When the class was started it was expected that a large number of entomologists would be needed in the Army, especially to help solve the "cootie" problem. The proceedings of the class have been mimeographed and sent throughout the country to entomologists who have enrolled. The knowledge of disease-carrying insects thus disseminated will doubtless find useful application, notwithstanding the termination of the war.

A Guide to Poisonous Range Plants.—Various bulletins have been published by the Federal and State departments of agriculture concerning plants that are poisonous to sheep and cattle on the western ranges. The latest of these publications, prepared by C. E. Fleming and recently issued by the agricultural experiment station of the University of Nevada as Bulletin No. 95, deserves special mention on account of the pains that have been taken to facilitate identification of the plants described. It is copiously illustrated with pictures in color, photographs and drawings, which, together with the clear and detailed descriptions, should leave no doubt in the mind of the nonscientific herder or stockman as to whether any of the plants in question are prevalent in his neighborhood. The symptoms caused by the several plants and methods of dealing therewith are also set forth. A Spanish translation of the essential parts of the bulletin is appended.

The Birds of Colombia.—As a first step toward a general zoölogical survey of South America under the direction of the American Museum of Natural History, a thorough study of the birds of Colombia has been in progress for the past seven years, and the results have lately been published by Dr. F. M. Chapman. This undertaking has resulted not only in the discovery of 22 species and 115 subspecies of birds new to science, but has also entailed a large amount of geographical exploration and the mapping of extensive regions hitherto little known. Colombia is a country in which "palms and glaciers, dripping forests and sandy deserts, tropical heat and blinding snowstorms, greet the traveler in rapid succession." Chapman's memoirs present maps and descriptions of the "life zones" of the country, such as cannot fail to be of great economic as well as scientific value. Between 1910 and 1915 the author organized eight expeditions into Colombia, two of which he led himself. Altogether 15,775 bird-skins were collected. A member of the expeditions was Louis Agassiz Fuertes, the well-known painter of birds, who has made some exquisite pictures in color of various birds collected.

Broken Diamonds.—In an article on the diamonds of the Kimberley mines, Dr. J. R. Sutton discusses the origin of the numerous broken fragments of diamond found in that region. One hypothesis current on the subject is that these fragments owe their condition to violent eruptive outbursts which shattered the rocks in which they occur. Another common belief is that certain classes of diamonds frequently break spontaneously. One authority states that light brown, smoky diamonds often crack on exposure to the dry air, but they will remain intact if kept in a moist place. In accordance with this notion there is a popular story of South African diamonds being sent to Engand inside potatoes. Crookes, in his Kimberley Lecture, seems to attribute the fractures to the sudden lowering of pressure in the space surrounding diamonds, and speaks of consequent explosion. Dr. Sutton says he has met plenty of people who have heard of the bursting of smoky diamonds, but none who ever witnessed this phenomenon with their own eyes. This idea of the bursting of diamonds is of high antiquity. Albertus Magnus says that a diamond immersed in the fresh, warm blood of a goat will burst—especially if the animal had previously browsed on parsley or drunk wine! Pliny vouchsafes a similar notion. Dr. Sutton believes that, in a majority of cases, the breaking of diamonds has been due to the energy exerted by the mineral inclusions which they so often contain. These are most frequently garnet, but sometimes zircon, ilmenite, iron pyrites, and possibly chrysolite. The thermal expansion of nearly all crystals, except those of the beryl family, at ordinary temperatures, is much greater than that of the diamond. If the same is true under plutonic conditions of heat and temperature, differences in the rate of expansion and contraction of the diamond and its inclusion would account for the shattering.

Automobile

Air Cleaners for Trucks.—The intensive study that circumstances has of late directed to the details of farm tractor problems has impressed on designers the pressing necessity for efficient air cleaners; and it is beginning to dawn on both designers and manufacturers that this device is equally necessary on trucks. The up-keep of a truck is a matter that the user naturally watches very carefully, and anything like an air cleaner, that will tend to reduce the cost of replacements, keep the truck out of the repair shop and prolong its term of service will appeal strongly to the purchaser.

An Advantage in Motor Truck Transportation.—There is one important advantage resulting from motor truck transportation that is but just being appreciated, and that is the saving in handling goods that results. The truck picks up a load at the door of the producer and delivers it directly at the doors of the consumers, and consequently the goods have to be handled but twice, instead of four or more times, as is the case when a shipment is made by rail. This means a considerable saving of time and expense, and the decrease in the amount of handling is often an advantage to the qualty of the goods.

Opposition to Motor Trucks.—One reason why more motor trucks are not used in our large cities is disclosed in an interview with a New York truck driver. He said: "The steamship docks and the loading platforms at the railroad stations are so crowded that I seldom handle more than two loads a day—often only one; but our motor trucks easily make five trips a day, and the men that drive them make only $4 more a week than I do. Our boss wanted us team drivers to handle motors, but we wouldn't touch them." While the present shortage of labor continues the drivers can do as they please, but opposition of this kind will be eliminated in the near future.

Rural Motor Express Lines.—The rapid increase in the number of commercial motor transportation lines is startling to those who have not kept in touch with the subject, and the results of their operation are solving a number of important problems. Among these may be noted the length of haul on which they can compete with the railroads, and the size of truck that can be employed economically. So far it would appear that routes of about 50 miles can be operated most profitably, but that it is doubtful if the motor truck can compete with the railroad at distances of over 100 miles. Experience also seems to indicate that a five-ton truck is the limit in size for economical operation; and still smaller trucks are better where special average loading factors do not exist.

Economy in Fuel.—The question of fuel supply is an ever present and important problem. With the decreased requirements for war purposes some of the fuel producers are intimating that there will be a surplus in the near future, but this only means that there will not be an excessive demand at the present inflated prices. Whatever may eventuate in this direction, the cost of fuel is an important item in operating expenses of commercial vehicles, and it is in this direction that sensational development is certain to take place in the near future. To promote this development builders of motor vehicles generally will forward their own interests if they devote their best efforts to increasing the economy of their engines, and reliable engineering authorities say it can be done.

Regulating the Driver.—The Laws of New York are a good example of how things ought not to be done, and a City Magistrate declares that under the existing laws the city is neither sane nor safe. Many of the reckless drivers are, he states, incompetents who have bought cars from suddenly acquired wealth, and as the regulations about qualifications for obtaining a license are a farce, anyone is permitted to operate a car. Moreover, as such people are not in the least restrained by either fines or imprisonment, the only way of restraining them is to revoke their licenses, for which no provision exists. The inadequate character of the automobile laws of this state results largely from the character of its law makers, many of whom are law breakers themselves in the operation of their cars.

Motor Trucks to Save Food.—On thousands of farms food supplies are produced that would be of great value to the public if they could be made available; but the quantity produced on many farms is too small to pay for hauling it to a market. In several parts of the country it has been found profitable to establish a rural motor truck express line, which regularly collects the small lots of produce from a dozen or so farms and carries them to the nearest market town, to the great advantage of all concerned. On their return trips the trucks bring out and distribute the current supplies of merchandise required by the farmers on their routes, thus saving the farmers a great deal of valuable time. These little rural express lines form most useful connections between the markets and rural districts that can be served in no other way; and there are innumerable districts throughout the country where similar transportation lines could be operated to mutual advantage.

Good roads vs. bad. A truck carrying acetylene for the ship-yards stuck in the mud between Baltimore and Philadelphia, and a truck which, over adequate roads, maintains a daily service between Connecticut cities and New York

Some Motor Truck Economics

National Standardized Roads for the Nation's Motor Traffic

By the Washington Correspondent of the SCIENTIFIC AMERICAN

WE are just beginning, as a nation, to realize the fact that unpreparedness for peace may bring as many serious problems for solution as unpreparedness for war. The word "economics" is bulking larger and larger in our business consciousness, as peace becomes more and more a reality. And more and more are we asking of any one we think may have any kind of an answer, "What are we going to do with those parts of our war machine which can be used in peace, when peace makes them no longer useful in war?"

Prior to the war the motor truck was making steady progress towards ultimate complete employment. More and more business houses were using it in local deliveries, more and more was it being recognized as an interurban factor as well as a local transportation means. In the course of time it would undoubtedly have arrived, to the place it occupies today. But the war accelerated its adoption, perhaps by twenty years. With the railroad situation so bad last winter it could only have been worse in a small degree and not at all in kind, the motor truck stepped in and did more than the country as a whole has any idea of, completely to solve the transportation mess in which the country found itself.

It is not yet permitted to state just how many trucks General Pershing has in France, or how many have gone to Italy, to Russia, even to England. A newspaper headline recently stated that General Pershing had 50,000 trucks ready to transport soldiers and munitions from the Western Front to any possible need in Austria. The figures are short of the mark.

When peace comes, so the unthinking man in the street argues, General Pershing will pack up his couple of million men and his impedimenta and (according to some shipping board optimist), spend a happy three months coming home. As a matter of fact it will be more than one year or two before the last American khaki clad lad leaves foreign shores. And those thousands of motor trucks will not be dumped unceremoniously on our shores in one large cavalcade. But many of them may ultimately come back, to add their wheels to those which are now cutting our already inadequate roads to a still greater degree of inefficiency and small pieces.

Whether they do or not is a small matter, compared to that other, larger matter of making the motor truck do for this country what it has done for the Allies. Transportation officers say the war could not have been fought without the truck and "Germany runs out of gasoline" was a newspaper reason for Germany's need of getting out of northern France and into her own country in a hurry. The motor truck has proved abroad what its enthusiastic sponsors have always known here—that it is the coming factor in transportation, and that the more it is used, and the easier it is made for trucks to run, the lower will be the cost of living, the more will time be saved, and the better can be performed that huge task of reconstruction which is none the less large in that the war has not brought physical destruction to this our country.

The prime factor in motor truck transportation is roads.

Up to our entry into the war we had almost totally neglected the subject of roads—neglected it as a nation, spite of much pork-barrel road legislation in Congress, of many earnest associations devoted to the subject of good roads, of a government agency (Office of Public Roads, Department of Agriculture), which has done, perhaps, all it could do with its very limited powers and appropriations.

What little we had done before the war has proved of small use. For instance, Maryland some years ago saw the light and began a campaign to provide herself with good roads instead of the atrocities with which she had made shift for many years. She produced a network of roads first class, from the standpoint of the farm wagon and the pleasure car. But her best roads were about as adequate to stand army trucking as an American hospital in France is adequate to withstand a Hun bomb! As a result, some of her finest boulevards—notably the road between Washington and the Delaware line—have been totally ruined. Maryland is quoted merely as an example, not at all as one unique.

Wherever the big army trucks have run constantly, there have roads gone to pieces. Any one who wants to see the worst roads in the world should go within 25 miles of any camp or cantonment. We simply never knew how to build a road which would stand the work required.

We built our roads as our forefathers built railroads—for the existing traffic only. As railroad cars and engines grew larger and heavier, the railroads took up their light rails and put down heavier ones, took up their small sleepers and put down larger ones, put them closer together; piled rock between them—made their road beds over and over again. Had they only known in the beginning, how much money might have been saved! So with our roads. We have built our macadamized roads, our bitulithic roads, our sand clay and our tarred roads, with the idea that a two-ton pleasure car with large tires or a small truck running at a restricted speed, would provide the maximum of wear. When a fleet of five-ton trucks uses such roads, a couple of trips tears them, these nice little play roads, to small bits and—we go ahead and build them over again, the same way. Is it sensible? Is it logical? Is it anything but politically American?

The use of the truck commercially has already demonstrated that there are some functions no other transportation means can perform. It is not the case of the truck competing with the railroad, but of the truck performing a service no railroad can render. There are certain commercial emergencies which require transportation of raw material or finished production in the minimum of time and with the certainty of delivery by a certain date. No one who has ever depended on freight but knows that the only thing certain about its time of delivery is its uncertainty.

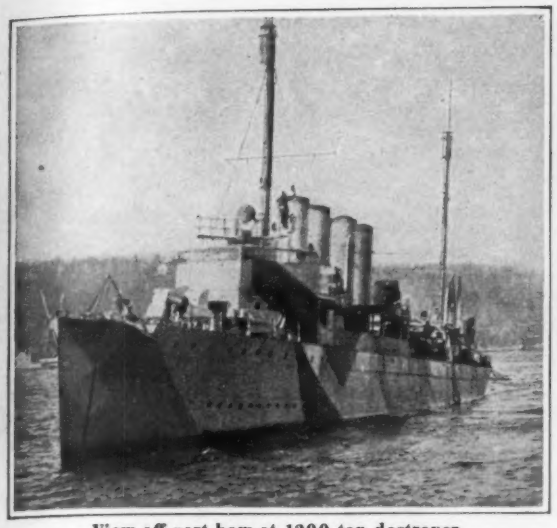
All railroads maintain a "lost car bureau" to hunt up missing cars, and it is obvious they are not always empty when missed. The motor truck cannot well get lost. It is not part of a train, it is not an insensate container depending upon a hundred intelligences rightly to read its directions and properly to forward it. It is a self-mover, bearing with it its conductor, its guiding intelligence, which takes it not only to the city to which it is to go, but exactly to the very door at which its load is to be delivered. Accidents eliminated, the motor truck is as dependable as to time as a passenger train, and avoids many expensive operations in its work. To ship a ton of tools, or bags, or sand or hats or pianos from factory to store requires their loading on something, transportation to the station, unloading there, reloading on the car, possible unloading at a central freight station, reloading to make up a "carload lot" to destination, unloading at destination, possible reloading on a local freight car, unloading at final destination, reloading on truck or wagon, and final unloading at the store. The motor truck loads at the factory and unloads at the warehouse and that is all there is to it.

(Continued on page 530)

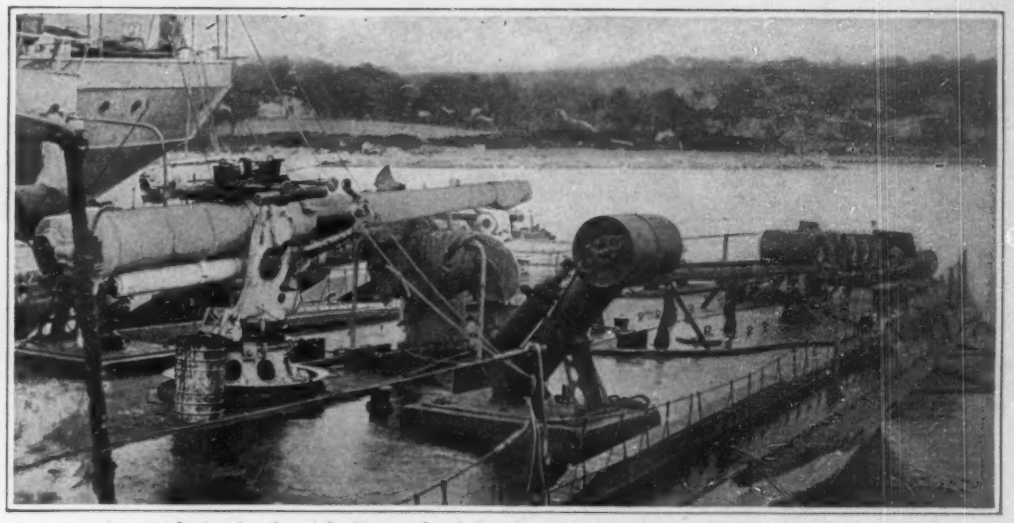
Copyright, Underwood & Underwood

Copyright Committee on Public Information

How the roads connecting Connecticut's munition centers with one another and with the steamship terminals at New York were kept open throughout the extraordinary winter of 1917-18 by means of motor trucks



View off port bow of 1200-ton destroyer
Note flush deck



Quarterdeck, showing 4-inch gun, depth-bomb mortar with bomb loaded into the muzzle and line of depth bombs at the stern

The American Destroyer

The New Type, the Depth-Bomb and the Other Accessories Which Have Contributed to Strafing the U-Boats

THE lifting of the censorship enables us to present some views of the latest type of American destroyer, of which we have several hundred built or building for the United States Navy. To those of us who are interested in the upbuilding of our fleet, these pictures possess very special interest, for our new destroyer fleet presents, so far as new construction is concerned, our principal, though by no means, our only contribution to the winning of the naval side of the great war.

It will be remembered that in 1916 Congress authorized appropriations for the greatest single addition that had ever been made to the United States Navy—the greatest, in fact, that has ever been made at any one time to any navy, not even excluding that of Great Britain. This program called for the construction of 10 dreadnought battleships, six battle-cruisers, 10 scout-cruisers, with a proportionate number of destroyers and other smaller craft. When we entered the war the enemy, baffled and defeated on the high seas, had abandoned his attack on surface warships and concentrated his efforts upon the monstrous attempt to sink at sight the unarmed merchant fleets of the world. It had already been determined that the most effective way to meet this attack was the arming of merchant ships and the construction of large fleets of destroyers, complemented by smaller patrol craft; and with wise provision, the Navy Department decided to abandon for the time being its great naval program, and concentrate its shipbuilding efforts upon destroyers, submarine chasers, mine layers, and the various other smaller craft, which had been proved by our Allies to be the best answer to the submarine and the mine.

By far the most important part of our wartime program was that which called for the immediate construction of a large fleet of destroyers of the new type which is shown in the accompanying photographs. Our existing yards, public and private, were readjusted for destroyer construction, and a large number of new shipbuilding ways with their shops and general plant were at once laid down. At the present writing, we have approximately one hundred destroyers completed and at least another one hundred and fifty in course of construction or authorized to be built.

The majority of these—in fact, all of the vessels built since the war commenced and now under contract, are of the new 1,200-ton type. The water line length is about 220 feet, the beam about 32 feet, with a draft of between 10 and 11 feet, according to load. As compared with our earlier 750-ton destroyers of the Nicholson class, this represents an increase of about 400 tons displacement, and the speed has been raised from about 30 knots to 35 knots. They are driven by turbines through mechanical reduction gear, and we understand that in service these boats have easily made 35 knots speed or more and that the motive power has proved to be thoroughly reliable.

The most notable feature in a first view of these vessels is the disappearance of the separate fo'c'sle deck with a break aft of the bridge to the level of the main deck, and the substitution of a flush deck from stem to stern. There is the same high freeboard forward as in the early destroyers—in fact, the freeboard is considerably greater, and of course the average freeboard of these vessels is several feet in excess of that of the old type. There is also, due to this construction, a considerable increase in strength, since the girder depth of these boats, and consequently their ability to resist bending stresses, is greatly increased for similar weights of material. The experience had with them in the stormy waters of the eastern Atlantic has shown that they are very strong and exceedingly able craft.

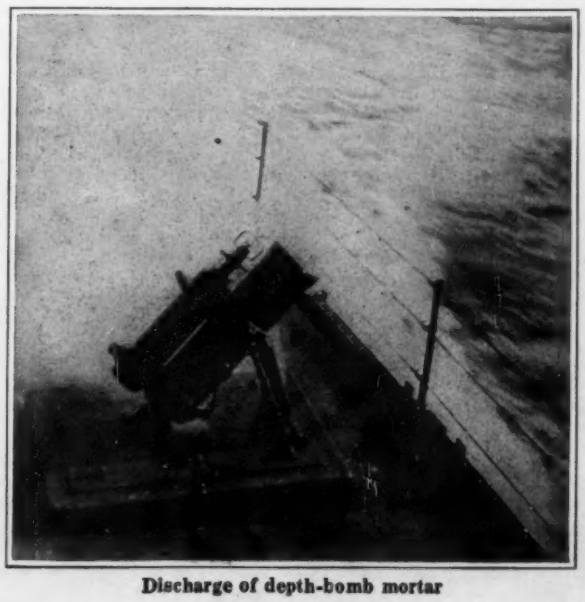
Explosion of depth bomb dropped from destroyer

Another advantage, of course, is the provision of more roomy accommodations below decks.

The armament consists of four long 4-inch rifles, one on the foc'sle deck, one aft, and two carried on a raised structure somewhat forward of amidships. In the early boats these two guns were carried on the beam at the break of the fore deck, and the lifting of them from the main deck to the level of the fo'c'sle deck, that is, through a height of 7 to 8 feet, gets them out of the way of broken water and gives them a much better command at all times.

The armament of a destroyer today is vastly different from that of pre-war times, for, in addition to guns and torpedoes, it includes the terribly destructive depth bomb. These are carried on sloping run-ways at the stern. When an attack is made they are released, one by one, and fuses are set so that the detonation shall take place as near to the estimated position of the U-boat as possible. In releasing the mines, care is taken to drop them sufficiently far apart to avoid the risk of countermining.

The curious short gun, shown in one of the illustrations, was developed for throwing depth bombs to a distance of from 80 to 100 yards, in cases where it was not possible immediately to maneuver the destroyer over the supposed position of the U-boat. The 300-pound bomb is provided with a plunger which is loaded into the gun, and the propellant is a small charge of powder contained in the smaller cylinder attached above the barrel of the mortar. It will be noticed that the photographer was so fortunate as to catch a depth bomb near the top of its flight.



Discharge of depth-bomb mortar

The bomb in flight

Shell of the Egg and the Skeleton of the Chick

A NEWLY hatched chick is remarkable for the sturdiness and vigor it displays, so different from the comparative feebleness of many other young animals. This strength and ability to stand alone obviously implies a considerable degree of firmness in the skeleton. But the rigidity of the skeleton is imparted to it by its content of lime, and since the lime contained in the white and the yellow of an egg is very small, amounting on the average to little more than 35 milligrams in an egg whose net weight is 60 grams, the question arises as to where and how the young creature obtains the extra mineral required. Two French investigators, Messrs. Delezeune and Fourneau, have been studying this problem recently and the results of their researches are published in a late number of the *Annals of the Pasteur Institute* (Paris). Their experiments prove indubitably that the lime contained in the shell of the egg constitutes a reservoir which is drawn on for the building of the skeleton. While a newlaid egg weighing 60 grams contains only 35.4 milligrams of lime (CaO) a fertilized egg which has been incubated for 16 days contains nearly twice as much (67 mg.). On the eighteenth day of incubation the amount has increased to 129 mg., and on the twenty-first day, *i. e.*, the day when the chick is hatched to 200 mg. In other words there is an increase of not less than 500 per cent in the content of lime during the period of incubation. In the egg which has not been fecundated there is on the contrary no increase whatever in the percentage of lime contained in the egg.

The mechanism by means of which the developing embryo is able to utilize the calcium stored in the shell is as yet unknown. The scientists referred to are endeavoring to solve this problem, which they will probably be able to, by analyzing the amniotic liquid which comes in contact with the shell, permeating the living membrane, about the seventeenth day of incubation.

The Truck Triangle

Operating Costs of the Single Truck Owner Versus Those of the Fleet Owner

By John S. Harwhite

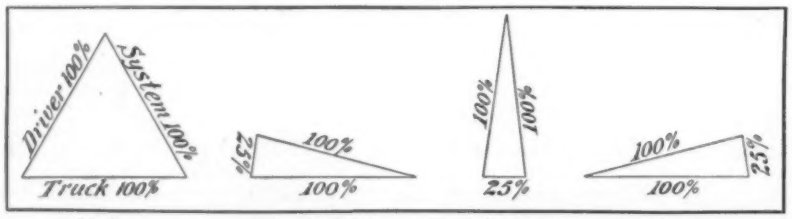
A PROMINENT truck manufacturer has likened the effectiveness of truck service to a triangle having as its sides the structural and mechanical worth of the vehicle itself, the ability of the driver, and the efficiency of the delivery system.

In order to include the greatest area, which in this graphic representation would serve to give the truck its maximum effectiveness, the triangle should be equilateral; thus a good truck should be supplemented by the best driver available and the two should be allowed to work under the most favorable conditions. There are many well-developed and properly-built trucks on the market; good drivers are at present scarce, but are, nevertheless, obtainable or can be developed; it is the efficiency of the delivery system which unfortunately varies and is a condition for which, as a rule, only the owner is responsible.

To develop this third side of the triangle and install the delivery system which will enable a good truck and a good driver to operate without waste of effort is not necessarily a matter of additional investment, or expert service. The owner of but one truck who does his own bookkeeping and spends his spare time during the evenings in inspecting and adjusting his machine is as well able to install an efficient and satisfactory delivery system as is the owner of a fleet of trucks who has at his disposal a high-priced auditing and bookkeeping department, a routing clerk, platform inspectors, and all the other adjuncts too often considered necessary for the transportation of goods. As an evidence of the fact that the truck owner doing business in a small way is as well able to operate his truck at its maximum efficiency as is the packing company or department store, it is interesting to note that one of the winners of a country-wide, national truck-efficiency contest was an unknown truck owner whose records were placed in competition with those kept by operators of fleets of trucks under the jurisdiction of experts in the auditing and mechanical fields.

The basic essential of a well-developed delivery system is a simple system whereby accurate record may be kept of the daily and hourly activities of a truck, the useful work which it performs, and every cent spent for maintenance and repairs, as well as the "overhead" costs. In this manner inefficient routing will be discovered, adjustments improved, the gasoline consumption may be measured, and an undue loss of time spent in loading, unloading or in traffic congestion may be corrected.

Suppose, for example, that a truck owner discovers from an inspection of his records that, although his delivery system is placed on a nine-hour basis, the truck is in operation but four hours of the day, and that, in addition, two hours are spent at the loading and unloading platform. It is evident from such an inspection that three hours of the time during which the truck should be available are not properly employed. Here is a waste which may be remedied by giving that particular track more frequent trips, or by rerouting it so that it may serve a larger territory. If it is discovered also that time is apparently wasted at the loading and unloading terminals, demountable bodies, movable crates, overhead cranes, or whatever type of body or loading device lends itself best to the goods to be handled, may be installed at a saving in time which will probably more than pay for the added investment at the end of the year.



The truck triangle showing its greatest efficiency when equilateral

No hard and fast rules for the installation of a truck service can be laid down. Each owner must vary conditions to suit his own requirements. Pneumatic tires, although higher-priced, may prove advisable for one owner, while solid tires should be selected by another. In this case, also, an examination of accurately-kept records will enable the owner or his traffic manager to determine the best equipment. The nature of the loads hauled, and breakage, as well as the speeds at which it is found necessary to run the truck, will determine whether the reduced vibration from the use of pneumatics will more than offset their higher initial cost and possible shorter life.

In the same manner the best route to reach a given section may be determined; and the truth of the adage that "the longest way round is the shortest way home" may be demonstrated if the roads in the one case are hard-surfaced and in the other are of the ordinary mud, dust and chuck-hole type too often representative of our rural highways. Inasmuch as experiments have determined that the hard-surfaced road requires but half the gasoline consumption and half the time to cover a given distance as that demanded by the ordinary country road, it becomes merely a matter of simple mathematics to outline the most suitable course between different towns.

But if a properly recorded cost-keeping system will demonstrate the necessity for efficient routing, proper adjustment, efficient equipment and mininum of delays, it will also indicate more clearly than any of these, the advisability of "return load" arrangements whenever possible. Inasmuch as the cost per ton mile is obtained by dividing the total cost of operation by the product of distance times load, a truck which must travel empty in one direction serves practically to double the cost of hauling the original load. However, the local truck club, merchants associations, and official state committees are uniting to remedy this evil and to make available for the owner of a single truck the same return load service as is maintained by the highly-developed organizations of larger corporations.

The truck triangle depends for its maximum area upon the extension of all three sides to their limit of 100 per cent efficiency. The truck which, no matter of how excellent design, is damaged in an accident or is held up for repairs will have a value of zero for its side of the triangle as long as it is out of commission. In the meantime, this will serve to bring the other two sides of the triangle to a common line and, as a line possesses no area, so will this particular truck installation represent zero effectiveness. The expenses attendant upon the maintenance of an effective system and upon the

(Continued on page 532)

The Trend of Tractor Development

A Brief Survey of the Direction in Which the Consensus of Design Appears To Be Moving

By Howard Warren

IF the world had not become involved in a war that taxed to the utmost the economic resources of every country in it, the tractor for agricultural work would doubtless have continued to develop at the rather deliberate rate at which it was moving previous to 1914, and a very considerable period of years would have had to elapse before the results now obtained would have become apparent. The war came, however, and with it the necessity for increasing food production notwithstanding a shortage of human labor that was, and is, appalling. The result has been a forced development that has had exceedingly interesting results.

Designers and manufacturers of tractors have been under two fires. There has been an insistent demand for speed in improving design and construction and also in production, for the call has been for more machines than even the most optimistic builders contemplated as possible for years to come. And at the same time the absolute necessity for good results has made it imperative that mistakes should be as few and as small as possible, for the whole world cries for food and yet more food. Makers who under different circumstances might have time to solve problems by the slow but sure process of years of field work have been forced to make sure that they were right with the least possible delay. Accordingly there has been as much progress during the last four years as 10 years would have seen had there been no pressure.

One result has been the practical elimination of the old-time tractor with its enormous weights and its crude mechanism in favor of types in which are combined the lessons that have been learned from the old machines, from motor trucks and from passenger cars. And another result has been the production of a large and widely varying assortment of designs, most of which include principles that are distinctly good because, as has been intimated, no manufacturer with an average degree of self-respect and responsibility could afford to take chances. Finally, there still are on the market a number of machines which may be said to embody not a few pre-war features such as heavy slow-speed engines, battery ignition, great tanks of cooling water, rough gears, and construction in which resistance to stresses is sought by the addition of plenty of metal.

Generally speaking, the present tendency is toward lighter weights, for the old idea that weight was necessary to traction has gone and it is recognized that efficiency demands that there be a maximum of useful power after the energy necessary to move the machine itself has been subtracted. This means efficient methods of preventing slipping, the proper distribution of weight, the securing of strength through the use of high-grade materials such as alloy steels instead of castings; and, where castings must be used, the adoption of scientific proportions so that there may be a minimum of idle metal. Especially it requires the use of efficient engines and of transmission systems less wasteful than their predecessors.

Even in the hauling capacity of the average tractor there has been a considerable change. Experience seems to have demonstrated that except on very extensive farms the extremely large tractor is not as economical as a smaller machine. The field of usefulness of the monster is decidedly limited, while the less unwieldy unit can be worked profitably under a wide range of conditions, and used in gangs where large tracts have to be plowed and cultivated. The majority of tractors built today are capable of handling three plows, it being usual to figure on 14-inch bottoms plowing seven inches deep under all conditions, or four plows under favoraole conditions. A two-plow tractor seems too small for the average farm, though it has its own distinct field of utility on small acreages and in large truck gardens. The three-plow tractor, however, is sufficiently mobile to be used in comparatively small fields without leaving much finishing to be done by horses; and it is just as useful on large tracts, where its lack of individual capacity can be made up by adding more units. Indeed, so far as the finishing of fields is concerned, there are not a few manufacturers who claim that their tractors are capable of plowing so close to fences and corners that horse finishing is unnecessary, and improvements in tractor plows and other implements have done much to make this possible. It is readily appreciated that a ponderous tractor capable of hauling 10 or more plows is utterly out of place except when there is a great acreage to be handled and big, heavy machinery to be belt-driven. A very large tractor is a two-man or three-man machine, while the smaller tractors are usually one-man or, at most, two-man machines.

The engines in most cases are four-cylinder types that resemble very closely the engines used for motor-truck work, and speeds range commonly from 750 to 1,000, instead of the old-time 250 to 500 revolutions per minute, which means far greater all-round efficiency and a very great reduction in engine weight. The fact that the transmission gears have to take care of a considerably greater reduction in speed is more than offset by the cutting down in gear weight. Systems now in use are built much as are good truck transmissions, with hardened, and in many cases ground gears running in oil in tight housings.

So far as ignition is concerned there has been a complete change. It is no longer considered necessary to use the simplest and crudest type of make-and-break, with dry cells as the source of current. The vast majority of tractors have high-tension magnetos, and the heavier types are almost invariably fitted with impulse starters. The impulse starter is a magneto attachment which, when the engine speed is too low to drive the magneto at a speed sufficient to produce a good spark, holds back the rotor while a spring is compressed and at the proper point in the stroke releases the spring and gives the rotor a sudden partial rotation producing a spark equivalent to that obtained at normal running speed. Thus it is not necessary to crank a heavy engine rapidly, for as long as there is an ignitable gas in the cylinders the engine will start no matter how slowly it is turned over. In many, if not most, impulse starters the spring automatically comes into action when the speed of the engine is reduced below a predetermined point, so that it will not stall for want of a hot spark.

Another common item of equipment that goes far toward making the tractor engine efficient and durable is the air cleaner, which frees the air taken into the cylinders of the dust that is so plentiful in the fields in dry weather. Centrifugal action, water and oil are used in different types of cleaners to separate dust from air and keep it out of the engine, where it is capable of doing a great deal of harm by mixing with the lubricating oil and so forming an abrasive that reaches all the wearing parts and is exceedingly difficult to dislodge.

The fuel question is absorbing a vast amount of attention, for when it is considered that the tractor engine works most of the time at or very near its full rated power it is readily appreciated that the consumption is considerable. The expense of gasoline makes kerosene and distillate look very attractive. Most of the tractors

(Continued on page 532)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Amateur Side of the Proposed Wireless Legislation

To the Editor of the SCIENTIFIC AMERICAN:

I wish to call to your attention, a bill, No. H. R. 13159, introduced by Mr. J. W. Alexander on Nov. 21, 1918, which was referred to the Committee on the Merchant Marine and Fisheries.

From articles which appeared in the press, this bill was interpreted by many concerned to only give the Secretary of the Navy the power to operate and maintain all commercial radio stations on land or permanently moored vessels now in existence, within the jurisdiction of the United States or any of its possessions, and that the commonly called *radio amateur* as classed in the radio law approved August 13, 1912, would still be allowed to erect, maintain or operate for private use, a radio station, if properly licensed, as provided by the Act to regulate radio communication, already referred to, which made the following distinction between different classes of land stations:

1. Public service stations (a) general (b) limited.
2. Limited commercial stations.
3. Experiment stations for the development of radio communication.
4. Technical and training school stations.
5. General amateur stations.
6. Special amateur stations.
7. Restricted amateur stations.

After a casual glance at an official copy of Mr. Alexander's bill, I was very much surprised to find that the "Radio amateur" of classes 5, 6 and 7, was not even mentioned. Evidently Mr. Alexander does not know the important part which the "radio amateurs" have played in the war for Democracy.

After the United States declared war on Germany, our Government sent out a call for several thousand *trained radio operators* which were needed at once in various branches of the Army and the Navy. The result was that more than five thousand radio amateurs, skilled in the operation of modern radio apparatus, enlisted or accepted civilian positions in the Army or the Navy. If Mr. Alexander had excluded the radio amateur from his bill of 1912, the radio personnel would not have been available for this great emergency, because dependable radio operators and radio experts, capable of operating and erecting modern complicated radio apparatus, cannot be trained over night, but require years of constant study and experimenting.

Statistics two years ago showed that there were over one hundred thousand radio amateurs in the United States, not taking into account the boys and others who were merely playing with radio. The amateurs, as they are called, are the real experts, for they work at wireless for the love of it; they are building new apparatus all the time, experimenting with improvements in materials and in methods, spending the greater portion of their leisure time at the work. They are the enthusiasts, and the professional operators are not, generally speaking, in the same class with them as has been proved on many occasions.

It was a New York amateur, Edwin Howard Armstrong, President of the Radio Club of America, who invented the regenerative action of the Audion Detector that has made possible many recent evolutions in the radio art. Mr. Armstrong is now Captain of the U. S. Signal Corps and has been in France for over a year as radio expert. The radio-controlled torpedo which will soon protect our coasts against invasion was invented by a former radio amateur, J. H. Hammond, Jr.

Below is a list of a few New York radio amateurs, members of the Radio Club of America, who are in the U. S. Government service, since we declared war on Germany, helping to solve the many problems from their knowledge obtained through experimenting with their own home-made amateur apparatus:

T. Johnson, Jr., Expert Radio Aide, in charge of Aircraft Radio, U. S. Navy.
Lieut. H. Sadenwater, U. S. Navy, Radio Officer, Aircraft Radio.
Lieut. W. S. Lemmon, U. S. Navy, Radio Officer, General Radio, U. S. Navy.
B. R. Cummings, Expert Radio Aide, General Radio, U. S. Navy.
F. W. L. Horle, Expert Radio Aide, General Radio, U. S. Navy.
F. A. Hart, Expert Radio Aide, General Radio, U. S. Navy.
G. Allen, Expert Radio Aide, General Radio, U. S. Navy.
L. Spangenberg, Radio Inspector, Aircraft Radio, U. S. Navy.
Ensign, T. J. Styles, U. S. Navy, Aircraft Radio.
Capt. D. C. McCoy, Radio Officer, Div. of Military Aeronautics.
J. O. Smith, Radio Expert, Div. of Military Aeronautics, and many others.

Now most of these amateurs are in the service, in Europe or the United States. Their lips are sealed and they cannot protest against the intention of the Alexander bill, now before Congress to suppress their future activities. Is it likely that these men who know the full meaning of discipline would interfere with governmental and commercial stations in the future? They will be keen to resume their researches and experiments. They will be doubly enthusiastic if the plan which I propose is put into effect for it will mean that they can continue to serve their country.

Radio will play an important part in the development of the Postal Air Service. It is the only known method of accurately guiding an aviator through fog. It will provide a means whereby he can communicate with a relief station if he is forced to land in an unpopulated part of the country. Radio will assure exact knowledge of the whereabouts of postal airplanes regardless of weather and will enable the service to correct schedules of delivery.

With restrictions as outlined in the laws of 1912, and using modern apparatus of the continuous wave type, the radio amateur cannot possibly cause interference with Naval stations. In my estimation, instead of eliminating the amateur, he should be encouraged to experiment more than ever, so that if the emergency should again arise, the Government will have at its disposal, many thousands of radio experts properly to operate and erect the radio stations needed on airplanes, tanks, balloons, warships, torpedo boats, troopships, land stations of many types, etc.

If this bill is approved, it means that the radio amateur will be completely ignored and only *scientists* will be allowed to experiment with radio apparatus of any description—receiving stations included. By a scientist,

John Merle Coulter

I mean a professor or highly technical engineer actually considered such by the Secretary of the Navy.

The writer has been a radio amateur for the last 12 years and although he is a radio engineer, in charge of the Radio Department of a large electrical company, being that he gained his first radio ability as a radio amateur, he is still an amateur at heart.

L. G. PACENT.

New York City.

[Since Mr. Pacent wrote the above letter an amendment has been prepared for the Alexander wireless bill, which reads substantially as follows: No amateur wireless transmitters are to be allowed within one mile of a Naval station. Amateur transmitters anywhere from one to five miles from a Naval station are to be limited to ¼ k. w. input; from five to ten miles, ½ k. w. input. In isolated districts the amateur may use any power needed. A license will be required for receiving stations, as well as for transmitting. The wave lengths permitted to amateur transmitters are to be from 150 to 250 meters. Further comment on the Alexander bill will be found on the editorial page of this issue.—THE EDITOR.]

Stems of Seedlings Injured by Excessive Heat

UNDER the name of "whitespot" Mr. Carl Hartley, of the U. S. Bureau of Plant Industry, has described a lesion which he has found in the young seedlings of conifers and other plants, and which resembles the common damping-off disease, due to parasitic fungi. It occurs usually just above the ground line, and is very light in color. Commonly the entire stem is constricted by the lesion, and the seedling falls over and dies. Mr. Hartley's investigations indicate that this malady is not due to a parasite, but to excessive heating of the soil in contact with the stem. Hence, to guard against "whitespot" the nurseryman should avoid soils especially liable to overheating, and in nurseries should artificially prevent heating, by shading, frequent light watering, etc.

To Our Subscribers

WE have reached the close of another year—the seventy-fourth of the SCIENTIFIC AMERICAN's life. Since many subscriptions expire at this time, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

The New President of the American Association for the Advancement of Science

By Marcus Benjamin, Ph.D.

THE American Association for the Advancement of Science meets annually during Convocation week; and this year Baltimore was chosen as its gathering place, largely on account of its nearness to Washington where so many scientific men are now engaged in applying their special knowledge to the best methods of winning the Great War. A distinguished botanist was elected at the Pittsburgh meeting to the high honor of presiding over the deliberations this week.

John Merle Coulter, the son of Moses Stanley Coulter and Caroline E. (Crowe) Coulter, was born on November 20, 1854, in Ningpo, China where his parents were engaged in missionary work under the auspices of the Presbyterian Church. On the death of his father in 1854 he returned to the United States with his mother and settled at her former home in Hanover, Ind.

In this small country town the boy grew to manhood and here he studied at Hanover College where he was graduated in 1870 and where he early showed an interest in geology and botany, an interest easily explained by the abundant resources of the vicinity in both of these branches of natural science.

In 1872 he was appointed assistant to Frank H. Bradley, chief geologist of the old "Hayden Survey," as the "Geological and Geographical Survey of the Territories" was familiarly called, and during that year while the Survey was investigating the region now known as the Yellowstone National Park his manifest interest in the flora led to his special assignment as botanist of the Survey. The collections were worked up in Washington during the following winter and published in the report of the Survey for 1872. During the summer of 1873 the Survey investigated the Front Range Region of Colorado and the plant collection was made the basis of the "Flora of Colorado" published in collaboration with Prof. Thomas C. Porter of Lafayette College; and this in 1885 developed into the "Manual of the Rocky Mountain Region" which in 1909 was succeeded by a revised edition prepared in collaboration with Prof. Aven Nelson of the University of Wyoming.

His ability as a scientist having gained recognition, he took up his life work as a teacher and returned in 1874 to his Alma Mater as professor of Natural Science. For five years he held this chair and then passed to Wabash College in Crawfordsville, Ind., where he was professor of biology until 1891 when he accepted the presidency of Indiana University. This important office he resigned two years later to take a similar connection with Lake Forest College, near Chicago, Ill. Here again, his stay was short; for in 1896 he became head of the department of botany in the University of Chicago where he has since remained.

His other activities in botany include the relationship of special agent in botany to the U. S. Department of Agriculture, which he held for several years, and his founding the *Botanical Gazette* in 1874 of which he is still the editor and which now in its sixty-sixth volume is one of the journals of the University of Chicago. He was also principal of the Bay View Summer School in 1893-6 and of the Winona Summer School in 1895-8.

His earlier writings were largely on the taxonomic side of botany, but he has gradually turned his attention to the morphology of his specialty and besides very many separate papers he is the author in book form of Manual of Texan Botany (1891); Plant Relations (1899); Plant Structures (1899); Plant Studies (1902); Morphology of Gymnosperms (with Charles J. Chamberlain) (1901); Morphology of Angiosperms (also with Professor Chamberlain) (1903); A Text Book of Botany (1906); Elementary Studies in Botany (1913); Fundamentals of Plant Breeding (1914); and Evolution of Sex in Plants (1914).

His academic honors include the degree of A. M., received from Hanover in 1873 and that of Ph.D., conferred on him by Hanover in 1882, and by Indiana in 1884. Dr. Coulter is naturally a member of many scientific societies including the American Society of Naturalists, the Society for Plant Morphology and Physiology, the Botanical Society of America of which he was president in 1897-8 and again in 1915-16, the Washington Academy of Sciences, the Indiana Academy of Sciences of which he was president in 1886, the Illinois Academy of Sciences of which he was president in 1910; the American Academy of Arts and Sciences, of the American Philosophical Society, and since 1909 of the National Academy of Sciences, also since the great war he has been chairman of the Botanical Committee of the National Research Council. Among his foreign affiliations are corresponding membership of the Linnean Society, the Botanical Society of Edinburgh, and the British Association for the Advancement of Science.

His connection with the American Association for the Advancement of Science began with his election to membership at the Minneapolis meeting in 1883, followed by his advancement to fellowship a year later. He served as secretary of the section on Biology in 1890 and then was made vice-president of the Section for 1891, delivering a retiring address on "The Future of Systematic Botany" at the Washington meeting in that year. In 1901 he again served the Association by being General Secretary and since he has been a member from time to time of important committees.

His long and valuable services to science received worthy recognition at the Pittsburgh meeting last winter when he was unanimously chosen to the presidency of the Association, an office previously held by the following eminent botanists: Asa Gray (1871), George L. Goodale (1890), W. G. Farlow (1904), and Charles E. Bessey (1910).

Motorizing the Mails

Using Trucks in Vast Numbers for Postal Service

By John R. Eustis

THE transportation services of the great armies which fought in Europe not only developed the number and usefulness of motor trucks, but brought another development in the size of individual fleets. It was not unusual in the last years of the war for a fleet of 10,000 motor trucks to be assembled for one particular job, such as moving an army corps to a new sector of a line, or from rest billets to trenches; and there is one instance of 30,000 motor trucks being operated as a single unit.

Before the war, the largest single fleet of motor vehicles in the world was that of the London General Omnibus Company, totaling just under 4,000. The Paris fleet of motor omnibuses at that time numbered about eleven hundred. But such fleets will be almost as small, in comparison, after the war as they were during the war. In other words, the development of large fleets will continue in ordinary commercial practice.

Unless its plans sorely miscarry the United States Post Office Department will soon own and operate the largest of all fleets of motor vehicles. In fact, this federal governmental department is now undergoing an extensive motorization. Within the year it has inaugurated postal mail service by airplane, and this has attracted considerable attention. At this writing the service between New York and Washington via Philadelphia has been in operation for many months and has achieved a remarkable record of reliability. Figures for a single month recently show but one day on which the airplane schedules over this route were not maintained. Another service has just been started between New York and Chicago with three intermediate way stations, which will carry mail between these two cities within 10 hours. This airplane mail service, however, is more spectacular than anything else, and it is doubtful if the next two years will witness the establishment of more than 36 routes, employing a maximum of 100 machines.

Against this is the plan for a wide application of motorized parcel post, which, under the able direction of Hon. James I. Blakslee, Fourth Assistant Postmaster General, is to provide thousands of routes throughout the United States over which motor trucks by the tens of thousands will operate, the vehicles to be those now owned and used by the United States Army. Neither is the aerial mail service comparable in volume with the use of motor vehicles in handling the mails within large municipalities. Because the motor haulage of mail matter in the cities was first established, it is fitting to discuss this phase first, putting over until later in this article the more interesting country-wide parcel post movement.

A short time back public attention was directed to the use of motor vehicles in handling mail matter in large cities, by the decision of the Post Office Department to abandon pneumatic tube services in several large cities, substituting therefor additional motor equipment. Congress tried to reverse this decision but its action met a Presidential veto. According to statements made at that time by postal officials the Department felt that the limit of efficiency in dispatching United States mails had been reached with the existing facilities in all of the large cities, and that the sorely needed increase in mail carrying facilities would have to be secured through an increase of motor equipment. In other words, that the motor truck is regarded as a chief instrument of future improvement in the postal service.

To date, the carrying of mail by motor trucks owned by the Government has been limited to the larger municipalities. The original policy was to have this service rendered by contractors owning their own equipment, but in the last few years a change to government owned and operated motor trucks has been gradually made. The same policy, it is said, will soon be extended to rural mail delivery routes, where the use of motor vehicles is warranted. Incidentally, the rural mail service and the parcel post plans fathered by Mr. Blakslee are two separate and distinct propositions. The success achieved with government owned and operated motor equipment in the large cities has been such that similar service will be provided in every city where the volume of mail warrants.

That motor trucks offer the fastest, safest, and surest way of transporting mail between post offices, substations, and railway terminals is reported to be the unqualified assertion of post office men in all cities where government owned vehicles have been in use. The records of the Chicago post office, for example, show a remarkable degree of reliability for the motor truck. During an entire year the fleet of Chicago mail truck made only one failure to every 2,900 trips—a performance said to be unequaled by any other form of mail transportation, not excluding railroads. This record is regarded as highly significant, because for years it was contended that motor trucks could not operate efficiently in Chicago's Loop District, on account of the severe congestion of traffic. Actual experience, however, proved that they were more economical and more reliable than the previous facilities employed there.

The heavy snow falls of last January furnished a severe test for the postal motor truck. In Chicago the official register was a total of 40 inches of snow, and yet deep snow did not result in a single failure to make deliveries. Similar reliability was reported from Philadelphia, where, throughout the period of abnormal snow-fall all deliveries and connections were made by motor trucks on regular schedule. One of the principal advantages on behalf of motor transport and postal service is its ability to cope with high peak loads. In such emergencies motor trucks can be worked almost continuously at high speed and thus readily handle the abnormal volume of mail which comes periodically, especially at Christmas time. This is not the case with either horse-drawn or underground pneumatic tube systems, both of which have definite limitations.

Chicago post office records furnish a fine example of the flexibility of motor transportation. During a single year the mail trucks in that city, in addition to performing their allotted work, handled 8,160 pouches of letter mail which should have been otherwise dispatched. During this period the trucks made 537,642 trips and only 154 pouches were delayed. In New York, Chicago, Boston, Philadelphia, and St. Louis government owned motor trucks now transport over 60 per cent of the first-class mail, besides handling the immense volume of other mail. In Boston, all important mail requiring close connections between post offices and railway terminals is dispatched by motor truck. In New York, 94 per cent of the total mail in recent years has been handled by motor truck and horse-drawn vehicles under contract. Recently, the contractors' equipment has been displaced by a fleet of over 100 government motor trucks.

The post office records show that the value of motor trucks is greatest where the volume of mail to be transported is heaviest. This is similar to results secured in many other fields and is the old story of full loads both ways, adequate loading and unloading facilities, and skilled handling—all promoted by a heavy volume of goods to be transported—producing maximum efficiency in motor haulage. At the present time government owned motor truck mail services are operating in New York, Chicago, Philadelphia, Pittsburgh, Boston, St. Louis, Detroit, Indianapolis, Buffalo, Nashville and Washington. Plans provide that the equipment in these cities be increased and similar service provided in at least 20 more large cities.

The establishment of a new motorized parcel post service connecting country districts with cities is barely a year old. It was originated to accomplish three purposes: To increase the Nation's food supply, to provide quick delivery of farm products to the consumer, and to make money for the Government. This explains why it has been popularly called the "farm-to-table" movement. With the signing of the armistice the scope of these particular plans was widened so as to embrace the taking over of many thousands of army trucks, together with their drivers, and placing them in postal operation. One bill now before Congress provides for the construction of 5,000 miles of new roads to be built out of the profits of the new mail service and to employ not only former soldiers but unskilled labor released from munition manufacture. In fact, the farm-to-table plans of the Post Office Department promise to be a most potent influence in bringing the inauguration of a real system of federal highways throughout this country.

Last winter the necessary Congressional action was secured permitting Mr. Blakslee to begin carrying out these plans. This included raising the maximum weight on parcel post matter from 50 to 70 pounds, and an appropriation of $300,000. Prior to the establishment of the first farm-to-table route in December, 1917, the Department had had several years of experience in operating motor vehicles in a small way on rural delivery routes. For example, a motor truck route from Washington to Leonardtown Md., had been in operation three years with a two-ton truck hauling a 1½-ton trailer. It carries the mail for 104 post offices, serves 102,000 people, and has paid a profit since the start. One of the first parcel post routes established last winter served mushroom growers at Oxford, Pa. The growers had been shipping over a ton of mushrooms each day into Philadelphia by express, but the express service broke down, and within three days the Post Office Department had a heated motor truck on the job. In the first three days' service the truck not only made quicker and more economical deliveries than had been the case with express service, but also made $30 profit each day for Uncle Sam. It is estimated that this one truck on this route will earn $12,000 a year, and cost to operate, including depreciation and overhead, about $4,200. These figures may be taken as a fair average of the results being attained on the 70 similar routes now in operation. In commenting on this feature, Mr. Blakslee recently pointed out the fact that 15 pounds of first-class mail, which costs the sender at the rate of about $155 a ton, pays the entire operative expense of a three-ton truck for a trip of 100 miles.

One often finds that the phenomenal profits being made by these postal trucks are being applied to the possibilities of the so-called rural motor express business. They are not so applicable because the transporting of first-class mail, or any other kind of mail for that matter, is a government monopoly exercised by the Post Office Department.

In a recent address Mr. Blakslee spoke in part as follows: "Relative to the establishment of motor vehicle mail routes under authority of Congress, there are now in operation such routes extending from Portland, Me., via Hartford, Conn., and New York, Philadelphia, Baltimore and Washington, to The Plains, Va.; also routes from Columbia, S. C., Savannah, Ga., to Statesboro, Ga., and from Columbus, Ohio, to Zanesville, Ohio; from Indianapolis, Ind., to Cincinnati, Ohio, and from Indianapolis to Louisville, Ky. These routes are mainly connecting or trunk line routes, and those in the South and Midde West will ultimately be connected up with those in the East. They are all laid out through producing territory to important market centers, and the purpose is to demonstrate the practicability, utility, and value of this method of transportation in bringing the farmer into immediate touch with the consumer, by giving a direct, expeditious, and reliable service at a

(Continued on page 534)

Carriers routing up parcel post for delivery
Variety of teams used in delivery of parcel post mail

Our parcel post motor trucks
Horse-drawn load of parcel post mail

The transportation of parcel post matter

Electrically-Heated Soles for the Aviator's Cold Feet

KEEPING warm is one of the military airman's greatest problems. Time and again the fighting airmen are confronted with the intense cold of the higher altitudes, and the resultant suffering and numbness seriously interfere with the work in hand, if, indeed, they do not lead to disaster. Hence it becomes a matter of prime importance to keep the airmen warm so that they may "carry on" in winter as in summer.

Of the various means of keeping the airmen warm, none has proved the equal of electrically-heated clothing. Heating units in the form of fine resistance wires are incorporated in the heavy coats of the airmen, and the warmth produced is utilized to the fullest extent. Because of the limited radiation of the heat, only a small amount of electric current is required to keep the crew of an airplane as warm as if they were sitting in a parlor in "Blighty." The feet, which are generally the first members to suffer from cold, are heated by means of electrically-warmed insoles, of the type shown in the accompanying illustrations. By means of flexible conductors and detachable connectors the heating units of the coats and the shoes are brought into circuit with the airplane generator, which is normally employed for furnishing current to the lights, wireless apparatus, and so on.

Copyright, Underwood & Underwood

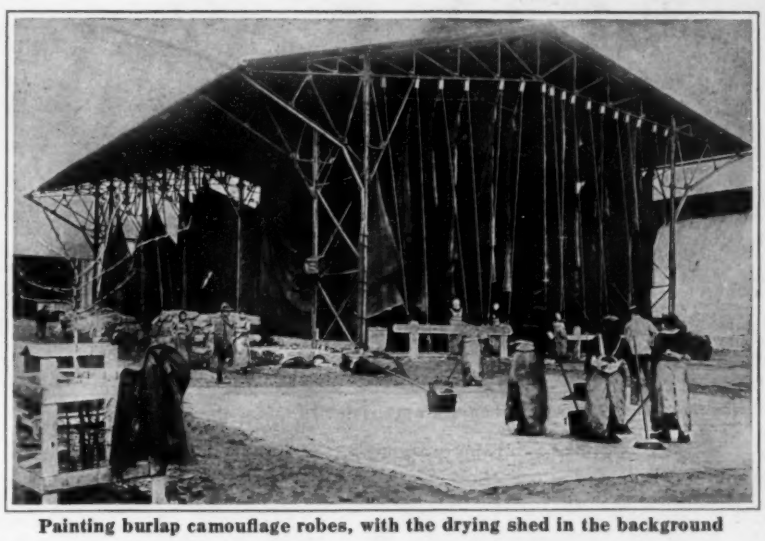
Putting the finishing touches on the electrically-heated insoles for British airmen

Where Camouflage Robes Were Made

SO vast was the quantity of camouflage material required for guns and other purposes in the war that a veritable camouflage industry existed behind the lines in France. The American Army alone maintained a large camouflage plant, where thousands of square yards of camouflage covering were prepared each month.

Some idea of the activities of a camouflage establishment may be obtained from the accompanying illustrations, which were made at an American depot in France. It will be noted that the burlap camouflage is laid out on the ground, in long strips. Large sheets of burlap camouflage were secured by sewing a number of strips together. As many as 10 layers of burlap were laid out on the ground and then painted by French girls equipped with long-handled brushes, much after the fashion of floor brushes or mops. The various colors were carefully applied, however, following the color schemes formulated by artists. Because of the porous nature of burlap, the paints soak through several layers, thus permitting of a crude form of quantity production. The canvas strips or sheets are hung up in huge sheds to dry, followed by folding or rolling for shipment to the front.

Another product of the camouflage establishment was grass matting. This was made by cutting raffa grass and then tieing it to wire netting. Over two hundred French women were employed in this work.



Painting burlap camouflage robes, with the drying shed in the background

Skin Diseases from Certain Lubricants

THE question of skin diseases caused by the use of certain cutting lubricants and cooling liquids has been looked into by the advisory council of the British Department of Scientific and Industrial Research. As a result of this investigation it is stated that oil rashes are, generally speaking, of two kinds, the first due to plugging of the small glands at the roots of the hairs on the arms and legs of workers, the second to mechanical injury to the skin produced by metallic particles suspended in the cutting lubricant. With regard to the first of these causes, the action of the lubricant is primarily purely mechanical; a mixture of oil and dirt blocks the minute openings of the glands and sets up inflammation round the hair. The inflammation may lead to suppuration or abscess formation. If many hairs are affected, the arm presents an appearance of a crop of raised red spots (papules), with a black spot as a center, or if the inflammation has gone as far as abscess formation, a yellow head.

In the second case minute metallic particles suspended in the cutting lubricant produce injury to the skin. This occurs chiefly on the hands, where two surfaces are rubbed together, as the skin between the fingers. Injury to the skin may also be produced on any part of the hands and arms by wiping with a cloth or rag while the hands or arms are coated with a film of fluid in which metallic particles are suspended. Injury to the skin allows germs to enter and causes septic infection.

As a preventive, washing accommodation must be on a liberal scale for workers in contact with oil. Hot water, soap and scrubbing brushes are essential. Workers should be instructed not to wipe their hands on rags, etc., before washing and to avoid washing their hands in the cutting compounds. Dusting the arms with a powder containing equal parts of starch and zinc oxide before commencing work prevents the action of the oil on the skin.

Care must also be taken in the handling of the constituents of a lubricant before blending, that they do not undergo changes, *e.g.*, formation of free fatty acid. Constant removal of metal particles is necessary to avoid injury to the skin. Filtration such as is provided on the machines, and centrifugal action, are insufficient to remove the minute metal particles which may injure the skin. Where cutting oils (straight oils) are used, their viscosity can be diminished, without affecting their value as lubricants, by heat which will allow the metal particles to sink. In other lubricants where such a procedure is impossible it is necessary to change and renew constantly the cutting lubricants. Frequent cleaning of the machines with the removal of all the old lubricant from all parts of the machine, is essential.

Various antiseptics, carbolic acid (one per cent to two per cent) being the most common, have been added to the lubricant to prevent rashes, and in the case of cutting emulsions 0.5 per cent of disinfectants soluble in water have been used for this purpose. The results obtained, however, have not been altogether satisfactory, and reliance cannot be placed upon such a method to prevent the skin rashes. It has been suggested to heat the cutting oil to 300 degrees Fahrenheit for a short period with a view to sterilizing it as well as to increasing its antiseptic action.

Laboratory experiments in America have shown that used oil possesses rather marked germicidal effects, and in view of the fact that the used oil becomes heated during use attempts were made to determine whether heating new oil would also bestow upon it germicidal powers. Apparently, heating does produce such a change, but the temperature required is upwards of about 260 degrees Fahrenheit. The action in the oil has not yet been determined but it has been recommended to mix new oil with the used oil before filtering and heating, so that the new oil would possess to some extent the germicidal power of the used oil.

Workers whose hands become septically infected should not be allowed to work on machines, as they are liable to infect others through the oil.

As a general rule, frequent washing with soap and hot water is sufficient to effect a rapid cure of folliculitis. The skin may be subsequently dusted with zinc oxide and starch powder. A mild antiseptic applied on lint has relieved the irritation and given good results. Septic infection due to cuts should be treated on general principles by the application of suitable antiseptic dressings. Individuals who appear to be particularly susceptible to the action of lubricants should not handle oil.

A New German Fighter

JUST before the signing of the armistice which brought all air fighting to a close, the Germans had introduced a new monoplane fighter about which there existed considerable mystery. It was reported to be equipped with a heavy rotary engine of 11 cylinders, giving it remarkable speed and climbing characteristics. This machine mounted four guns, presumably shooting directly ahead and synchronized with the engine as in standard chaser practice. In head-on fights the monoplane is said to have been a dangerous adversary.

Group of pictures copyrighted by Committee on Public Information

French peasant women cutting raffa grass for the making of grass matting

Spreading out burlap strips, ten layers thick, for the women painters

Post-War Status of Motor Truck Industry

Condition Created by Sudden Ending of the War

By Harry Wilkin Perry

WHEN the great German war machine collapsed suddenly and the armistice bringing hostilities to an end was signed in November, the truck manufacturers of the United States were confronted unexpectedly with the many highly important problems of reconverting their energies from a war program to a peace basis. Many of the leading manufacturers were working under high pressure at 100 per cent of the capacity of their plants on orders for thousands of army trucks, while on the other hand large numbers of truck assemblers were operating on an enforced reduced schedule of production of motor trucks for civilian requirements and were bound by their pledges, given to the War Industries Board, to sell only to essential uses.

While, therefore, the hoi-polloi was joyfully celebrating the victory of the Allies with spontaneous parades throughout the country, the manufacturers in the automobile industry, as in other industries, were endeavoring to readjust their thoughts and plans to the change in conditions brought about by the terms of the armistice. They realized that work on war orders would have to cease quickly, and that to keep their employees on their payrolls it would be necessary to resume their regular production of trucks for business purposes with the least possible delay. They were eager to do this, but were tied hand and foot by regulations of the War Industries Board through priority certificates and by pledges.

The Board was prompt to realize this and within 10 days removed the restrictions, so far as priorities and pledges to sell only to essential uses were concerned. Manufacturers may now place orders and secure deliveries of materials and parts for production after January 1st without any governmental restriction, just as before the United States entered the war, and their dealers may sell trucks to any one who desires to purchase, without regard to whether they are to be used for essential or so-called non-essential purposes. The manufacturers' pledges to build only the number of trucks allotted to them in their industry priority certificates will, however, remain in force until the end of the present year.

Removal of the restrictions does not make it possible for the manufacturer immediately to resume full normal production. Assemblers who had little or no war work had for a long time been unable to secure deliveries of engines, axles, transmissions and other parts and materials which were required for the building of military trucks, while manufacturers engaged in building standardized B trucks and other special products for the army were very short of materials suitable for their regular commercial models. Even with an open market, it is anticipated that several months will be required to replenish the stocks of all the companies, and good business judgment is expected to make the manufacturers conservative in purchasing at present prices of materials and uncertainty as to how long these prices will be maintained.

Parts and equipment makers have been short of raw steel and iron, brass, aluminum, tin and other materials; and after they receive new supplies, considerable time will be needed to produce finished parts in quantities. Hence, it is not to be expected that production of civilian trucks will get under full headway before next spring.

To keep labor fully employed during this reconversion period, governmental agencies are exercising caution in cancelling war contracts, with a view to tapering off in such way as to work the least hardship on labor.

So long as the cost of living remains at approximately the present level, it is improbable that the wage scale will be lowered materially, although a general drop in the prices of manufactured products must tend eventually to force wages downward. But until materials and wages do come down and truck manufacturers get into full quantity production, it is not reasonable to expect any general or important reduction in prices of motor trucks, which were inevitably forced upward by these conditions during the last two or three years.

Notwithstanding the limitation placed on production of commercial vehicles during the last six months of 1918, the total output of civilian trucks for the year will be 67 per cent larger than in 1917. The total output last year was 109,800. During the first half of this year, the production was 90,900 and the allotment for the last half was 91,700, making a total production for the year of 182,000. This does not include trucks built for the war, and when readjustment is completed next year and facilities devoted to war work are absorbed by peace production, the output will be further increased.

Probable demand for trucks this winter and next year is an unknown quantity, but the need for transportation still exists and the necessity for efficiency and economy in transportation will probably be even greater than heretofore. War conditions have fully proved the motor truck as a transportation means. Farmers have increased their acreages and adopted the most modern means of production. They have made money and should become large purchasers of trucks, as well as of farm tractors.

Hundreds of rural motor express lines have been established throughout the country. This movement has only now got a fair start and will undoubtedly grow to large proportions, creating a demand for many trucks. Such motor routes are proving a boon to farmers who live along them and enjoy the benefits of regular daily service for the shipment of all farm products to town and delivery at their gates of whatever may be required from the city, whether it be clothing, a package of sugar, a victrola, or a pound of nails.

Railroad embargoes and slow and uncertain shipments by rail during the congestion of traffic incident to the war have taught thousands of merchants and manufacturers the advantages of making shipments by motor truck up to distances of 100 miles or more, and they may be expected to continue such practice, either patronizing hauling companies or purchasing trucks for their own individual use.

Business throughout the country is on a much larger scale than in pre-war times, and is bound to continue on an expanded basis, because stocks of all kinds are depleted all over the world and must be replenished. Following a brief period of uncertainty while readjustment is going on, manufacturing in all lines may be expected to be very active, with consequent need for more and better transportation. It has been the history of every war that after the declaration of peace the victorious countries have enjoyed a protracted period of prosperity. In the present case, nearly all the world is looking to the United States as its chief source of supply for foodstuffs, raw materials and manufactured products. Without doubt, exports will expand as rapidly as shipping becomes available. Among these exports will be considerable numbers of motor trucks. The American shipbuilding program is to be continued, with especial view to production of ships most suitable for commerce. This will add greatly to the merchant marine of the country, and ships will be released by the army when the expeditionary forces have been returned home.

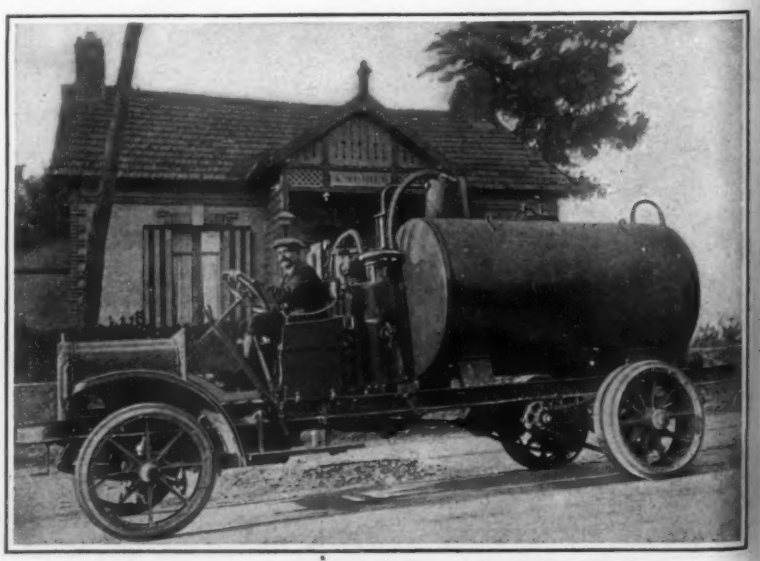
All of this will result in great expansion of the foreign trade of the United States, which has gained enormously in good will among the nations by its attitude and accomplishments in the war.

There has been some speculation as to the disposition to be made of the army trucks in Europe and in use by the military forces in this country. No pronouncement has been made by the War Department of its intentions along this line, but it is the consensus of opinion among leading men in the automobile industry who have a close

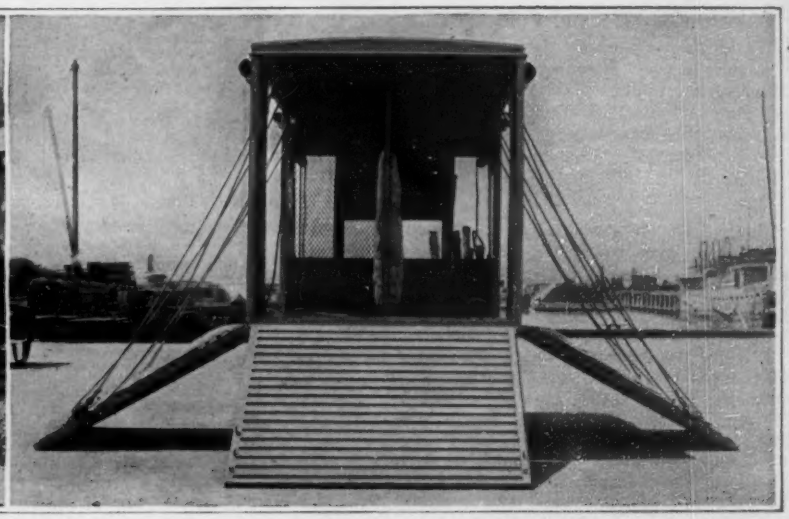
(Continued on page 534)

Uncle Sam's truck repair shop at Camp Holabird, Md.—the largest in the world

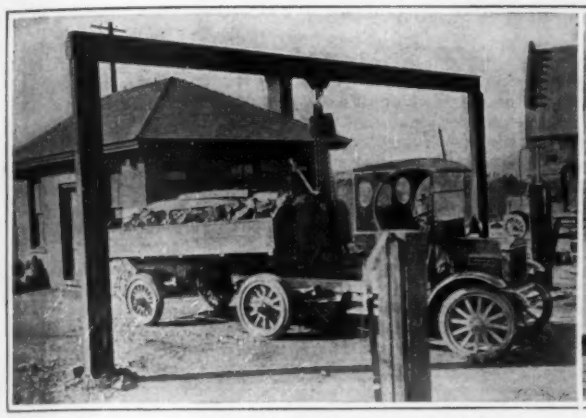
In long-distance hauling, via the highways, of all classes of commodities, the motor truck is just beginning to find its place



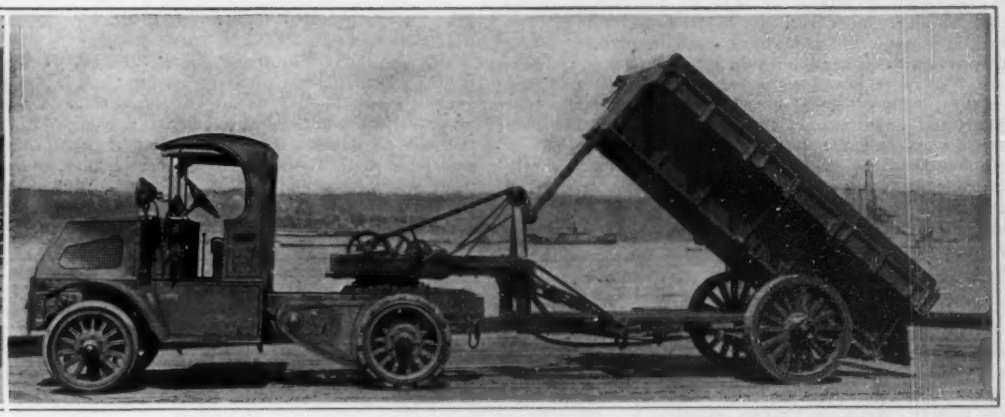
American truck used as a trench scavenger. It is fitted with a tank and powerful suction pumps



Special padded motor truck for transporting thoroughbreds. The truck holds six horses. The sides open out to facilitate unloading

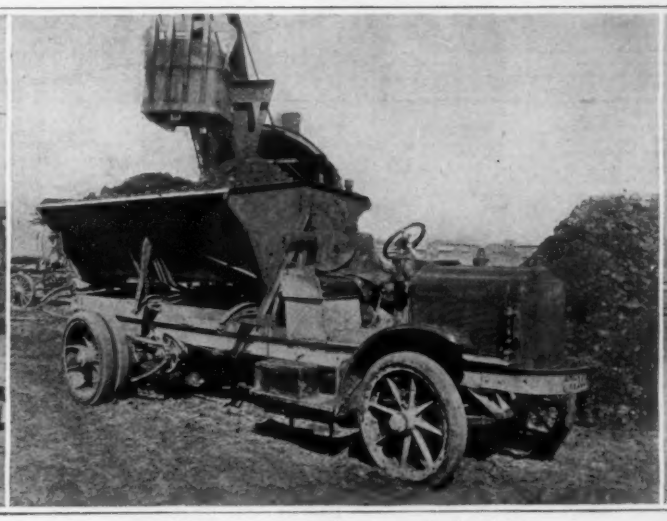


Holding up the trailer while the tractor is withdrawn



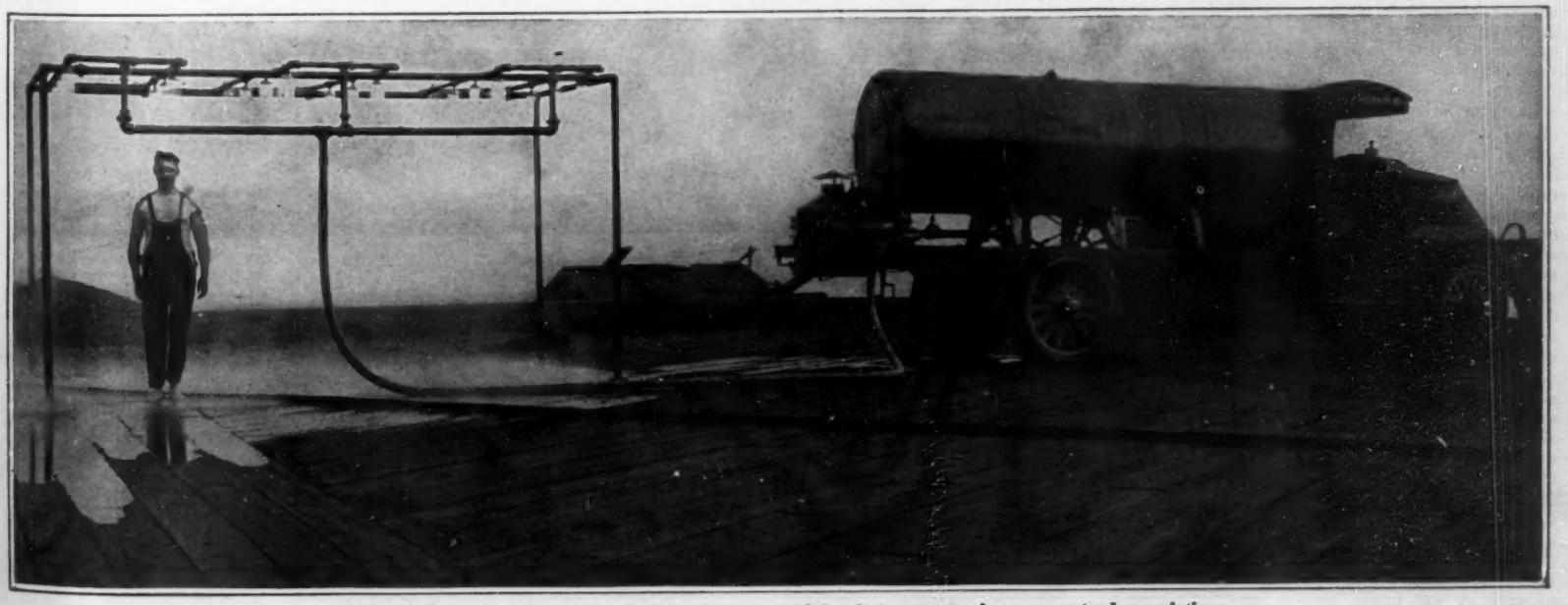
Motor truck hauling a dumping trailer which can be operated at any angle

Overhead loading track on a truck



Steel tip cars mounted on a truck chassis

Ash car being hoisted to dumping position



The de-gaser—a tank truck fitted with a heater supplying hot water to cleanse mustard gas victims

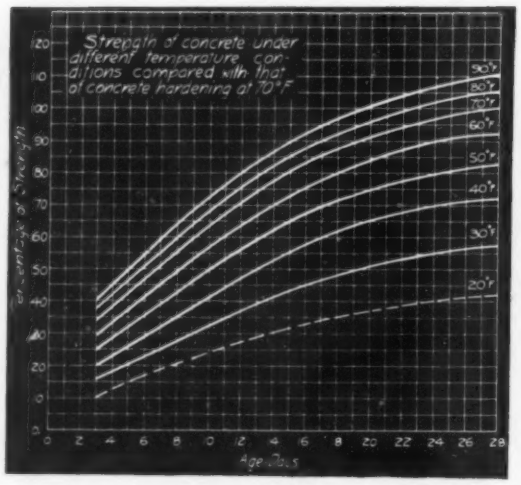
SOME NOVEL MOTOR TRUCK AND TRAILER APPLICATIONS AND APPLIANCES

Concrete and Cold Weather

FROM the very nature of the work, it is seldom possible to proceed with the laying of concrete when the thermometer stands well below the freezing point for a long period of time. The difficulties met with in water supply alone under such conditions are sufficient to discourage. However, it frequently happens that it is desirable to continue concreting—especially concrete road building—for a few days at the tail end of the season, when freezing temperatures may be expected intermittently. It is accordingly desirable to know just what effect such temperatures have upon concrete and not so much upon old concrete exposed to them, as upon concrete which is laid down in freezing weather. How do such initial conditions affect the permanent characteristics of the concrete in question?

It seems possible that, within reasonable limits, the effects of cold weather during the laying are merely to retard the setting, rather than to inhibit it altogether. The curves presented herewith certainly suggest that, if we give it time enough, concrete set when the thermometer is down will attain the requisite firmness. But we can seldom afford to give it all the time there is, and in any event we want to know how much time we will have to give it.

These curves are the result of tests by Professor McDaniels of the University of Illinois. The strength exhibited at the end of 28 days by concrete hardened and stored at a temperature of 70 degrees Fahrenheit has been taken as 100 per cent, and the performance of concrete under other conditions referred to it as a standard. While in practice the conditions which prevailed in these tests of uniform temperature throughout the hardening period are not to be realized, the results seem sufficiently valuable for serious consideration. It is obvious that the colder the weather the more slowly concrete sets; and that careful attention must be given the question of how much additional time should be allowed before putting into use concrete buildings and roads constructed at temperatures materially below 50 degrees.



The slow setting of concrete laid down in cold weather, as compared with that laid at 70° Fahrenheit

A Timely Adjustment

DAYLIGHT saving has brought home emphatically to all of us the fact, which so agitated Huck Finn's nigger Jim, that while the days are imposed upon us by the scheme of the universe, the hours are made by man and by man must be regulated. Before daylight saving came to do this, the establishment of the standard time zones, back in 1883, did it to a less extent; and to a still smaller degree we are reminded of human control over the hours, minutes and seconds by the necessity for setting our watches back or forward an hour every time we cross one of the zone boundaries laid down 35 years ago.

The convention of 1883 made an intolerable situation supportable; but it by no means made it ideal. No matter how or where we lay down our time zones, we must cause some local inconvenience. So mewhere on every east-and-west route there must come two adjacent towns whose local times are an hour apart; somewhere there must be cities that have to keep two times, one for incoming and one for outgoing trains; somewhere there must be places where standard time is half an hour or more behind the sun or ahead of it; somewhere there must be places which have striven to eliminate this discrepancy by introducing a new discrepancy between local and standard time—places where you are called at 7.30 to catch a 7 o'clock train.

The work of 1883, however, seems almost to have been done in such a way as to maximize rather than minimize these inconveniences. The meridian representing 82½ degrees west of Greenwich, which theoretically separates Eastern Time from Central, runs right through the heart of the Lake Erie industrial center; and this fact of itself makes much confusion inevitable. To this the time convention of 1883 added by making the Central Time zone far wider than it should have been made—so that standard time on its eastern border has been far too slow, while along its western edge the error in the opposite direction was even more glaring. Mountain Time, on the other hand, dwindled to almost nothing at its southern extremity, so that in passing through El Paso one practically jumped two hours, from Central to Pacific Time, at one blow. And as local market centers crystallized with the growing-up of the country, it was found that more and more of the lines of demarcation separated communities which, commercially and industrially, were one.

There has been little opportunity to correct any of these infelicities, except by the local action of communities which insisted on using the time of the zone to the east or west of theirs, or of railroads which insisted on moving their particular jumping-across points to a more convenient location. But today this opportunity exists as never before and, perhaps, never again. With our railroads all under one control, and that control closely associated with the time-signal service that emanates from Washington, it requires no prolonged discussion, no convention at which opposing elements have to be compromised as best they can, to move the zone lines eastward or westward; it requires but a single and simple executive order. It is in fact the Interstate Commerce Commission that issued the order, effective January 1st and diagrammed in the map on this page; but to the existence of the Railroad Administration must be attributed the possibility of its successful application.

It will be seen that the old zones are shown shaded, while the new boundaries are laid down in heavy lines. The meridians shown are not the central ones for the various zones, whose time is that used by the entire zone, but rather the ones, 7½ degrees east and west of those, which serve theoretically to bound the zones.

The general tendency of the change has been to move the boundaries west in the more thickly populated sections, and to move them back east in the sparsely settled regions, where they have been altogether too far west. This, it will be noted, carries out the spirit of daylight saving; Ohio in particular is the beneficiary. Instead of Buffalo and Fittsburgh being the official limiting points, Toledo and Columbus and Cincinnati become the dividing towns; and the entire industrial section of western New York, northwestern Pennsylvania and eastern Ohio gets an additional hour of daylight, without reference to the setting back of the clock. Among the cities which have already seized this benefit for themselves we might mention Jamestown, N. Y., and one situated at no less a distance from the previous dividing line than Detroit. Further south, practically the whole state of Georgia and all of Florida except the tiny corner that forms a business dependency of Mobile, in another state, set the clock permanently back an hour on New Year's Day.

The changes which move the Mountain Time zone out of the lap of the Pacific district and put it back where, longitudinally, it belongs, are made rather in the interest of railroad operation. Locally they are of no less interest to the people affected, but there are not so many of these, so in their general influence they are practically confined to the sense in which they were devised. As a matter of fact, it would seem that in at least one respect this change might have been better advised; we should think the Nevada desert would have provided a less inconvenient place to draw the line than through the middle of the Salt Lake population center, and a similar remark might apply where the Butte-Helena region is similarly bisected. However, there can be no question that the boundary has been put back to the place where nature would have it; and certainly it is an advantage to Arizona to have its northern and southern transportation arteries on the same time basis as one another and as the rest of the state.

With this map, we present also an interesting time conversion chart, designed by Lieut. Thomas Appleby of the United States Naval Reserve Force. Shortly after we entered the war, the Naval Communication Service, operating our radio stations in conjunction with those of our Allies throughout the world, found very necessary a satisfactory means of quickly converting the time used in different localities. When it is recalled that radio stations, although located on different sides of the globe, may be called upon for simultaneous action in sending out a general bulletin or in some other connection, it will be seen that difference of time becomes a serious consideration, and one calling for a more convenient means of adjustment than is ordinarily supplied. With the passage of the Daylight Saving Bill, and of similar legislation in other countries, the matter is enormously more complicated.

It is, of course, possible to look up in some standard reference volume the difference of time between any two points. But this takes time, and is liable to introduce error—especially the error of adding when subtraction is in order, or *vice versa*. To eliminate this Lieutenant Appleby designed his table, which has been adopted by the Naval Communication Service.

The table, as will be seen from the illustration, numbers the hours from 0 (midnight) to 23 (11 P. M.), and shows the day. To read the table, it is merely necessary to locate in the index column under "Place" the point at which one is stationed, and then similarly to locate the place whose time is to be referred to the local time. Corresponding hours in these two places will then be found in the same column; and since the actual hour is given, rather than a mere correction figure, there can be no error.

Account must of course be taken of whether summer time is prevalent at either or both of the points in question; if it is, this matter is adjusted by using the summer time column in place of that showing standard time. Thus, when it is 12 o'clock standard time in Washington, the column tells us that it is 17 o'clock (5 P. M.) standard time in London, and 2 o'clock (A. M.) standard time, tomorrow, in Tokyo. The names of local points other than those printed can of course be inserted—in particular, that of the place in which the table is being used. When summer time is in effect at either point involved, that point merely moves up one row.

TIME CONVERSION TABLE

Longitude East	Standard Time	Summer Time	Hours Begin at Zero (0) Midnight, and Continue to 23, (11 P. M.)
	PLACE		TODAY / TOMORROW
180			12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11
165			11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10
150	Melbourne, Australia		10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9
135	Tokyo, Japan		9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8
120	Manila, P. I.		8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7
105			7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6
90			6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5
75			5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4
60			4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
45			3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2
30	Alexandria, Egypt		2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1
15	Rome, Italy	London	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
0	London (Greenwich)		0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
15			23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
30			22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
45	Rio de Janeiro		21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
60	San Juan, P. R.	Washington, D. C.	20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
75	Washington, D. C.	Chicago, Ill.	19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
90	Chicago, Ill.	Denver, Colo.	18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
105	Denver, Colo.	San Francisco, Calif.	17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
120	San Francisco, Cal.		16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
135	Sitka, Alaska		15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
150			14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13
165			13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12
180			12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11
Longitude West			YESTERDAY / TODAY

The table that tells at a glance what time it is all over the world

The shaded areas show the existing time divisions of the country; the heavy lines bound the revised zones; in effect at 2 A. M. on New Year's day

Inventions New and Interesting

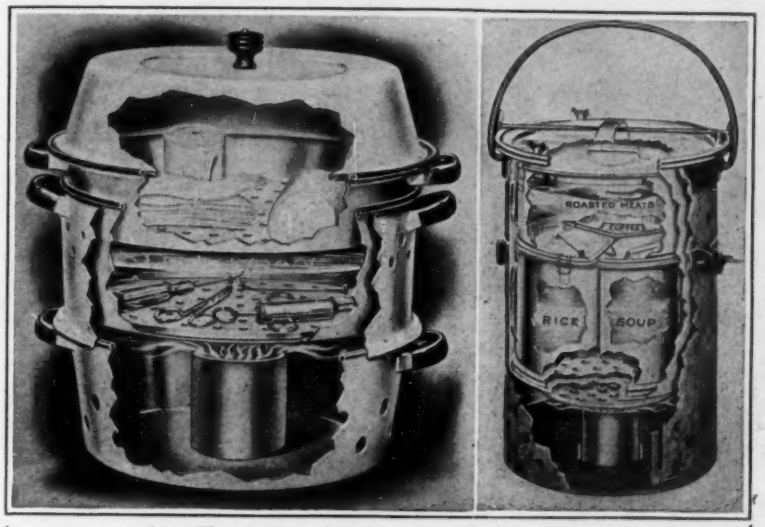
A Department Devoted to Pioneer Work in the Arts

Novel Uses for Alcohol in Solidified Form

As a convenient form of heat, there appears to be no end of uses for solidified alcohol. Our Army and other armies have been using vast quantities of this fuel because of its efficiency and convenience, so that it has come to be recognized as a military necessity. Yet solidified alcohol is primarily an everyday fuel, and as such it is now coming into its own with the gradual disbanding of the armies.

Two of the latest devices for use with solidified alcohol, are a sterilizer and a food heater for airplane transportation service. Both of these are the inventions of Mr. I. Popper of New York city, whose other devices for use with solidified alcohol have been described in past issues.

The sterilizer invented by Mr. Popper is made of steel, white enameled, with a height of 13 inches, diameter of 13 inches, and a weight of 11 pounds. Nested, ready to carry, it measures nine inches high. It can be used indoors or outdoors for sterilizing instruments, gauze, and bandages. The instruments are placed in the lower container on a perforated plate which rests on the bottom, as shown in the accompanying illustration. The upper container, which contains the perforated holes, is used for sterilizing the gauze and bandages. By using an eight-ounce can of solidified alcohol, a pint of water or solution can be brought to a boil in six to seven minutes. Steam generates in this time, and the sterilization is effected by steam.



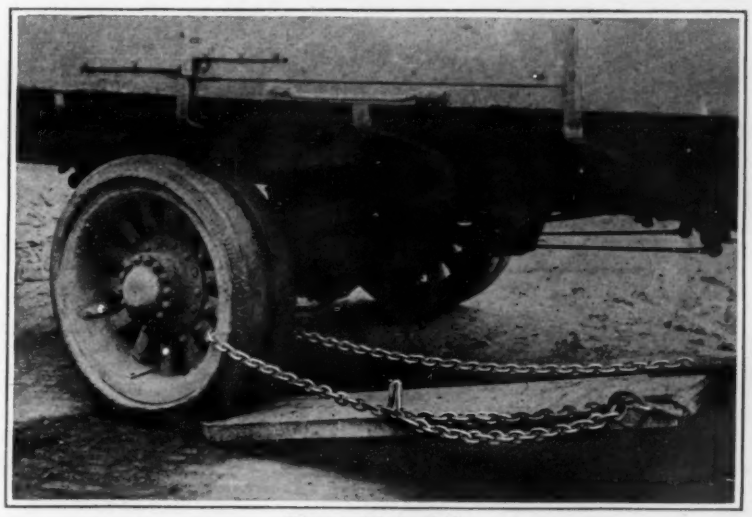
Two new uses for solidified alcohol: A convenient and efficient form of sterilizer, and a food heater for airplane use

The food heater for airplane transportation service is shown in the second illustration. It weighs 27 pounds and measures 17¼ inches high by 11¾ inches in diameter. The outer jacket is made of 18-gage galvanized iron while the large container is made of tin, the latter having a capacity of 16 quarts. The four food containers are made of aluminum; three of them are of two-quart capacity and the remaining one of four-quart capacity. Using an eight-ounce can of solidified alcohol, the heater keeps its contents warm for two hours or more.

Skidding Out of Trouble

ONE way to get a motor truck out of a mud hole is to lift it out with a derrick; and more traditional procedure involves digging it out or drawing upon the neighboring farms for horses. All these remedies will become obsolete if the claims made on behalf of the simple little device shown herewith are justified by its performances under stress.

The mud-hole skid consists, as the cut indicates, of a stout board and a length of chain (or cable). When the wheel gets into a hole that refusesto give the tread necessary for extrication, the skid is brought into play. Its end is tucked beneath the front exposure of the mired wheel, and the chain, made fast to the skid at one end, is passed through the wheel and anchored to the skid again. Then, when the motor starts, one of two things is bound to happen; either the wheel will roll out upon the board while the board is drawn in under the wheel —or something is going to break. The sturdy construction of the skid is well calculated to make the latter alternative an unlikely one.

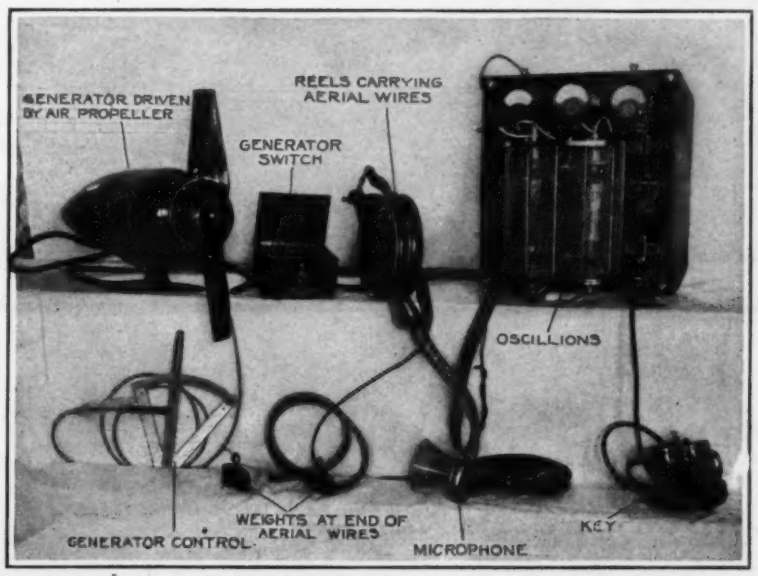


The mud-hole skid

'Phoning between Airplanes and Ground

THE recent official demonstrations of radio telephony between ground stations and airplanes leave little doubt of the relative perfection of that latest means of communication. To be sure, this news is startling; for it is only two years ago that radio men did not hold much promise for wireless communication between ground stations and airplanes. As they pointed out then, an airplane is a noisy and shakey location for a receiving station, so that the difficulties of receiving messages are multiplied many fold. On the other hand, sending wireless signals from airplanes has not been difficult; and since the early days of the war this method of communication has been in use for artillery regulation. So it follows that the feat of telephoning to an airplane from a ground station, is quite a step forward in the new art.

As yet, a complete description of the apparatus employed is not available. The system employed appears to be a form of vacuum generator for the transmitter on the ground, and a vacuum tube with possibly a vacuum amplifier for the receiving set. Equipped with helmet receivers similar to those employed for the intercommunicating telephone system aboard large airplanes, it becomes possible to eliminate most of the engine, propeller and other noises. Needless to say, the airplane receiving set must be of the sturdiest construction to resist the intense vibration of the engine.



Transmitting set for radio telephony between an airplane and other airplanes or the ground

The accompanying illustration shows a radio telephone set designed some time ago by Dr. Lee DeForest of New York City, for use on airplanes. It is a simple transmitter, using vacuum tube generators for creating the necessary train of undamped oscillations. It will be noted that the mouthpiece of the microphone is enclosed within a second mouthpiece of glass, so as to exclude undesirable noises. The various parts of the set being plainly indicated, a further description is unnecessary.

It will be noted that the set illustrated is intended for radio communication from an airplane. Its range is considerable. If the operator prefers to send his messages in telegraphic form, he can do so by using the key shown at the right.

American vs. British Patent Protection

Extracts from the Presidential Address Delivered by Sir Robert A. Hadfield before the British Gas Industries

[NOTE: Sir Robert A. Hadfield is a prolific inventor and one of the world's leading metallurgists. His steel mill in Sheffield ranks with the largest establishments in Europe in the production of high grade and special steel products and in the manufacture of projectiles he is one of the world's leading authorities. He is a member of the Munitions Inventions Board of Great Britain, where he has done yeoman work in increasing England's military effectiveness. He is the inventor of manganese and low-hysteresis steels. Concerning the former, Mr. Osmond, the eminent metallographist, has said that this invention "has not been merely the discovery of a new alloy, curious and yet useful, but that it ranked as a discovery equal in importance only to that of the effect of quenching in the history of the metallurgy of iron, the only one of the same order which it has been reserved for our age to make."

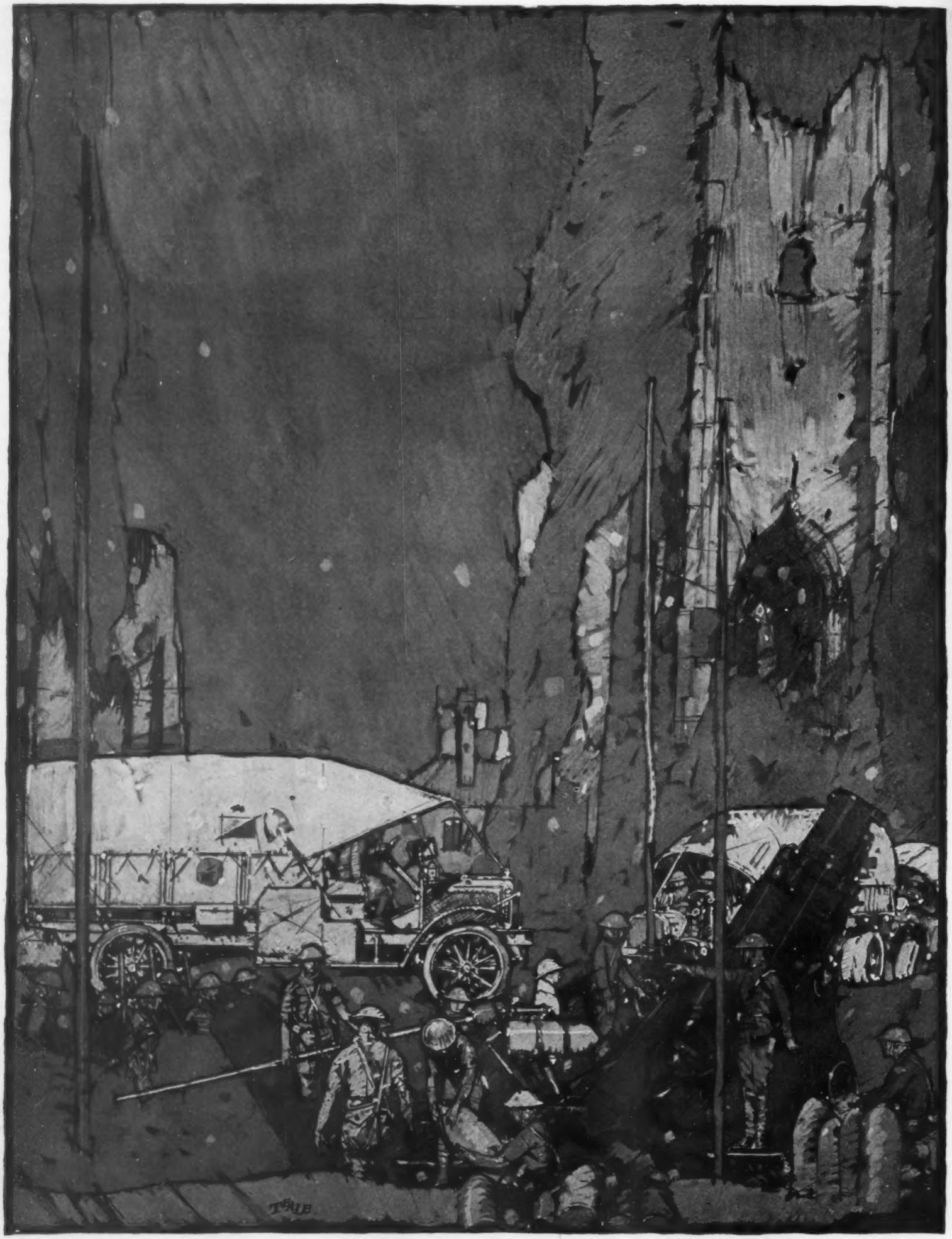
Among the numerous honors he has received from learned societies it is only necessary to mention that he was awarded gold medals for his discoveries and contributions by the British Iron and Steel Institute, the French Société d'Encouragement pour l'Industrie Nationale, and the American Franklin Institute.

No foreigner is thus better equipped, both through his career as an inventor, and his standing in a highly important art, than is Sir Robert A. Hadfield to comment upon our Patent System. His words of appreciation of what America owes to her patent laws and procedure thus have the value of force and authority and are highly informative and educational.—EDITOR.]

"AS showing how Patents for Inventions strike a 'new' nation, it may be mentioned that the Japanese Government, when considering the establishment of a Patent System on the lines of that created by the American Patent Act of March 1st, 1899, appointed Mr. Takahashi their special Commissioner to Washington, D. C. On being asked why the people of Japan desired to have a Patent System, he replied:—'It is only since Commodore Perry in 1854 opened the Ports of Japan to foreign commerce that the Japanese have been trying to become a great nation, and we have looked about us to see what nations are the greatest, so that we can be like them, and we said: 'There is the United States, not much more than 100 years old, and America was not discovered by Columbus until 400 years ago.' We said, 'What is it that makes the United States such a great nation?' and we investigated and found that it was Patents, and we will have Patents.' The writer in every way agrees with this wise statement by the Japanese representative, and wishes his countrymen would insist upon a British Parliament giving to the British Empire a Patent Law as liberal and as equit-

(Continued on page 536)

Type of vacuum-bulb generator employed



WHITE TRUCKS
have the Stamina

First in War

WHITE TRUCKS have won distinguished recognition in all the main theaters of war. Prolonged military service is a drastic test. It searches the very marrow of truck capacity and endurance. In the great emergencies of modern battle, motor transport furnishes the life blood of the armies, renewing and maintaining their fighting strength at widely distant points. Motor transport was

Essential in the Mexican Expedition
Indispensable to the Defense of Verdun
A Mainstay in the Battle of the Somme
A Foil to the Great German Offensive last March.

These were but high points in a wide range of war service in which White Trucks, honored by a leading part, met every demand and measured up to the highest ideals of motor transport service.

In Mexico. On March 19th, 1916, five days after the order was received in Cleveland, a complete motor train of White Trucks reached Columbus, New Mexico, and crossed the border with rations and supplies for Casas Grande, the first of a chain of field bases established by General Pershing's army. The line of communication was rapidly extended four hundred miles into a hostile and almost impassable country.

The first train was quickly followed by nineteen others, which day after day during the entire campaign operated with the utmost regularity over sharp, rocky trails, up steep grades, through deep sand and boggy morasses.

At the French and Russian Fronts. Over ten thousand White Trucks have been put into field service by the Allied armies abroad. During four years of warfare these trucks have stood up in a manner to merit the admiration and confidence of their military users. Order after order has been placed by the French and Russian Governments, based upon performance.

So satisfactory has been this performance that thousands of White Trucks were selected by the French General Staff, early in the war, to compose part of the Great Headquarters Reserve—a high tribute to pay any equipment in a modern army. Should all other truck organizations or transport facilities fail, the Great Headquarters Reserve would stand in the breach.

And these trucks DID stand in the breach on several critical occasions. They took a vital part in the prolonged defense of Verdun—three thousand strong. They assisted in rushing 350,000 French troops to the front to stay the German onslaught last March, an achievement in speed and endurance which won for the truck personnel repeated citations for distinguished service in battle.

In This Country. In building and supplying the sixteen army cantonments, White Trucks performed surprising feats. At Camp Funston, for instance, three truck companies hauled three thousand freight car loads of material in ninety days and relieved a serious congestion. The loads varied from tooth picks to five-foot water mains and included 35,000,000 feet of timber. White Trucks are now hauling immense quantities of food, clothing and other supplies needed by the soldiers.

As a result of their military record, the demand for White Trucks in both the French and American armies has reached such proportions that the factory production is now devoted entirely to war work—100% production of the company's *own* truck product.

This record of war service visualizes the important part played by motor trucks in fighting at the front and in sustaining intense industrial effort at home. In sparsely settled Mexico, along trails which other vehicles had difficulty in traveling, motor trucks kept supplies following on the very heels of the advancing cavalry. In densely populated France, where railroads abound, motor trucks have been indispensable as an *additional* means of transport.

"In this country war production might have broken down had there not been motor truck service to relieve the conjested railroads. The war has brought home to the American people, as nothing else could, the economic value of motor trucks and good roads, in peace and in war, as a vital link in the transportation system of the country."

The WHITE COMPANY
Cleveland, Ohio

RECENTLY PATENTED INVENTIONS

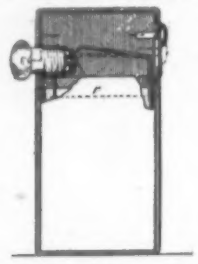
Pertaining to Apparel

SWEATER.—FLORENCE B. BIGGS, 133 W. 71st St., New York, N. Y. Among the objects of this invention are to provide a closed garment with a predetermined ripping section to avoid the destruction of the garment if occasion arises for hasty removal, as in case of injury to the wearer, to strengthen the construction of the garment adjacent the line of severance, to reduce the time factor in the manufacture, and to secure uniformity of size and finish of the garment.

UNION GARMENT.—W. B. STRAUB, Pottsville, Pa. The invention relates to garments made in practically one piece and serving the purpose of a plurality of separate under garments. The object is to produce a union garment in which the strains due to bending the body of the wearer are so distributed as to avoid unduly distorting the garment or allowing the garment owing to strains upon it, to distort other parts of the cloth or to cause discomfort to the wearer.

Electrical Devices

FLASH LIGHT AND BATTERY.—M. MIZRAHI, 106 E. 113th St., New York, N. Y. This invention relates particularly to the economical construction of a flash lamp. Among the objects is to provide a construction of dry cell battery and



A VERTICAL CENTRAL SECTION OF THE DEVICE

casing, the latter being of cheap material such as straw board or the like, and providing in direct connection with the battery a socket and movable contact members adapting the same for use in place of the usual high priced casing. The device being complete, except the lamp bulb.

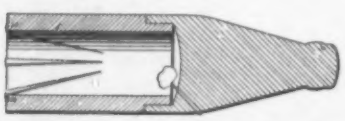
FLASH LAMP WITH EXTENSION.—W. A. ERICKSEN, 235 61st St., Brooklyn, N. Y. The invention relates to an electric flash lamp of suitable form for carrying in one's hand or pocket or for use on or in connection with various tools or machinery, usually for temporary purposes, but which may be supported in relatively fixed position. Another object is to provide a flash lamp with an extension having facilities for coiling the extension within the casing while the device is being used as an ordinary flash lamp.

ELECTRIC SIGN FLASHER.—J. A. KARPEL, care of Louis Levine, 35 E. 2d St., New York, N. Y. The invention relates to electrical display devices and has particular reference to variable contact means operated from a single source of power and perferably in a substantially continuous manner. Among the objects is to improve the details of construction of a rotary multiple make and break device with reference particularly to the prevention of burning out of the contacts by arcing.

WATER LEVEL ALARM FOR DRIP PANS.—C. C. JOHNSON, 89 Carpenter Ave., Newburgh, N. Y. This invention relates to an electric float-controlled alarm for water levels to be employed in connection with the drip pan of a refrigerator or in connection with an analogous water receptacle. An important object is to provide an attachment that may be readily applied to a drip pan and readily connected up with the electric alarm circuit or disconnected in the placing and removal of the pan, and to provide means for adjusting the alarm.

Of General Interest

MOUSE TRAP.—N. H. ALBRECHT and W. A. BALDWIN, 413 Sixth Ave., Dawson, Ga. This invention has for its object to provide a simple, inexpensive yet efficient mouse trap, wherein a casing is provided having at one end a removable cover carrying bait and having at the other end



A VERTICAL SECTION OF THE DEVICE

means for preventing return movement of the mouse when it enters the casing, said means, however, permitting the free entrance of the mouse.

TOBACCO BAG.—V. M. COMBES, 329 The Arcade, Cleveland, Ohio. An object of the invention is to improve the construction of self-closing tobacco bags, by use of an expanding spring so constructed as to insure the complete closing of the bag when partially or entirely filled. A further object is to provide an expanding spring which will not interfere with the filling of the bag, and which is sufficiently rigid to permit the bag being opened and closed by the use of one hand.

CIGARETTE CASE AND LIGHTER.—F. LAURETI, 191 Ferry St., Jersey City, N. J. Among the special objects of the invention is to provide a cigarette case adapted to hold a number of cigarettes, the case having combined with it automatic lighting means so arranged as to make possible the lighting of the cigarette while a portion of it is still within the case but with one end of the cigarette projected and grasped between the smoker's lips.

CLOSURE FOR CULTURE CONTAINERS.—B. BARLOW, 3559 S. Western Ave., Chicago, Ill. The object of this invention is to provide a closure so constructed that it admits air at all times in sufficient volume for the best growth of the culture, yet preventing excessive evaporation of moisture, it insures the removal of gaseous and volatile products, and prevents gas pressure within the container, thus preventing rupture or blow-out, and filters the entering air preventing any contamination after the closure has been applied.

CIGARETTE HOLDER.—S. NASCHER, 136 W. 116th St., New York, N. Y. An object of this invention is to provide an inexpensive, convenient and attractive box so arranged that by a jar imparted to the box a cigarette and matches are protruded from the box, the cigarette box may be utilized in connection with the matches or without, according to the desire of the manufacturer and customer.

GUN SHIELD.—J. B. STROUD, Pass Christian, Miss. The invention has for its object to provide an armor shield adapated for use with motor vehicles, carrying machine guns, wherein three motorcycles are connected together to move as one, and wherein expanding and contracting shields are provided for the riders of the same. In use the rider of the center motorcycle operates the gun, the outside riders guiding the structure.

BOOK HOLDER.—E. GRAHAM, Wray, Colo. This invention has particular reference to a device for holding heavy volumes from which typewritten copies are to be made. Among the objects is to provide a holder so constructed that the book will always be open flat irrespective of its thickness or the proximity of the work to be copied to either of the back boards.

YOKE OR SHOULDER WEIGHT CARRIER.—R. P. ORR, 35 S. Manning Blvd, Albany, N. Y. An object of this invention is to provide a construction adapted to fit against the shoulders in such a manner that weights connected therewith will be supported evenly over the entire shoulders. A further object is to provide a yoke and attachment whereby bags, packages or containers of any kind may be connected with the yoke in such manner as to be supported from the lower edge of the yoke, or from the upper part.

JAR LIFTER.—E. C. BAECK, Hawkins Ave., Lake Ronkonkoma, L. I., N. Y. The object of this invention is to provide a lifter more especially designed for engagement with jars containing fruits, vegetables or the like, to be set in boiling

A SIDE ELEVATION SHOWING THE GRIPPING ARMS

water, and arranged to enable the user to readily place such jar into the vessel containing the hot water or remove it therefrom without danger of burning or scalding the hands.

STAGE SETTING.—R. W. TULLY, 200 W. 57th St., New York, N. Y. The object of the invention is to provide a stage setting arranged to enable an actor to successively appear in two different roles and without the audience realizing when a desired change is effected. To produce the desired result, use is made of a hollow structure representing a hedge, wall or similar device, and set transversely of the stage approximately at the middle thereof, the structure having a passage sidewise therethrough to provide a front hiding portion and a rear entrance therein.

PRODUCTION OF SCENIC EFFECTS.—R. W. TULLY, 200 W. 57th St., New York, N. Y. The invention relates to theatrical appliances and its object is to provide improvements in producing scenic effects, notably scenes enacted in a heavy fog or smoke, to render such scenes exceedingly realistic and approaching the natural effect of such fog or smoke drifting. To accomplish this a screen stretched across the front of the stage is illuminated to produce an apparent fog or smoke effect.

STAGE APPARATUS.—R. W. TULLY, 200 W. 57th St., New York, N. Y. The object of the invention is to provide a stage apparatus especially designed for changing the positions of two persons so that one disappears and the other occupies the position of the first person. Another object is to permit of making the change pass without detection by the audience thus enabling an actor to play two roles in the same play.

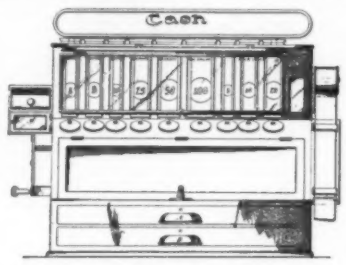
DETACHABLE FLAGSTAFF HOLDER.—R. F. AMERICA, 1218 S. 16th St., Philadelphia, Pa. The invention relates to a flagstaff holder adapted to be secured to a window sill, or the like and more particularly to a holder in which the staff socket or holder proper is readily attachable to a separate base plate fixidly secured to the window sill or other support and readily detachable from the base plate. A specific object is to produce a metal holder which is light and strong, and attractive when set up for use.

INFANT'S TOILET CHAIR.—E. E. CARRE, 70 Halsey St., Newark, N. J. The invention relates to a folding chair, and more particularly to an infant's toilet seat, the object being to so construct the device that it is reliable, simple to manufacture and of such design as to enable the chair to be easily and quickly folded and unfolded and to take up comparatively little space when folded, the chair having interlocking connections between the back and side or arm members.

SAFETY PIN.—P. C. HUNTER, 191 9th Ave., New York, N. Y. This invention comprises a body merging into a pair of pointed safety pin members, the body having a connecting bar merging into sections extending at right angles thereto and a plurality of diagonally arranged bracing members interlocking at a central point, and sheet metal members wrapped around the sections overlapping the ends of the pins for protecting them.

CABINET.—H. H. TURCHIN, 50 Northern Ave., New York, N. Y. The object of the invention is to provide a cabinet which forms a smoker and poker outfit, and is characterized by a card carrier secured to the door, and which carrier has a swinging basket for chips, the basket carrying a smoker's outfit, and the whole being balanced so that the basket and smoker's outfit are maintained always in a vertical position when the door is moved to close or open the cabinet.

MONEY HANDLING DEVICE.—J. M. ARNDT, 917½ S. Main St., Lima, Ohio. An object of the invention is to provide a device for handling money wherein a normally inaccessible compartment is provided for storing



A FRONT ELEVATION OF THE DEVICE

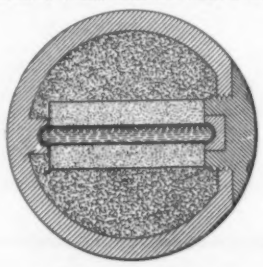
the cash equivalents of all sales, and another accessible compartment or change drawer from which the proper change is to be made and delivered to the customer, the difference representing the amount of the sale being dropped into the inaccessible compartment through chutes and registering devices.

PENCIL SHARPENER.—C. DEL. ALLEN and J. C. MAUGANS, 501 W. 133d St., New York, N. Y. Among the principal objects which the invention has in view are to provide a reservoir for dust and other waste produced when sharpening a pencil, to provide a fixture having renewable sharpening exposed surfaces, to furnish in a single apparatus a plurality of sharpening surfaces, and to simplify and reduce the cost of construction.

SPRING STEEL BAND.—W. R. SPRINGER, Oskaloosa, Iowa. The object of this invention is to provide a spring steel band adapted for tying up mail matter, as for instance, packages of letters and the like, wherein the band may be used many times, the band having interengaging means at its ends for permitting it to be attached about the package, this means being adjustable for various size packages.

APPARATUS FOR PRECIPITATION.—D. C. WALKER, P. O. Box 433, Anaconda, Mont. An object of the invention is to provide an apparatus for the continuous precipitation of solids from a solution flowing through the apparatus. Another object is to provide an apparatus in which the precipitate may be removed without interrupting the process of precipitation. A further object is to provide a simple automatic apparatus for the precipitation of solids from liquids.

SHELL.—M. B. ADOM, 297 Fifth Ave., White Plains, N. Y. An object of the invention is to provide a shell which contains sulfuric acid and a mixture of potassium chlorate moistened with hydrocarbons, which does not need a detonating



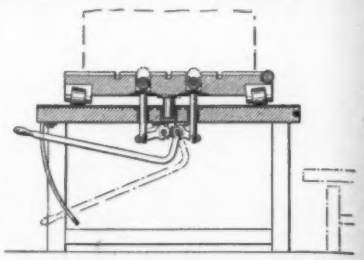
A SECTION OF THE SHELL

compound or fuse, and by means of which any of the propeller explosives may be sent off by a shock. A further object is to provide an explosive which is inexpensive and can be easily prepared just before it is to be used.

BALE TIE.—C. F. MOORE, Cushing, Okl. The particular object of the invention is the provision of a simple buckle which will be effective in use, and which may be made from a single piece of material bent to form. A further object is the provision of a buckle bent from a single length of material, in the bending of which all acute angles may be avoided so as to obviate danger of crystallization of the metal.

PROCESS OF SEALING BOTTLES.—A. L. BERNARDIN, Evansville, Ind. The invention relates generally to the capping of bottles, but more particularly to a process of sealing bottles in connection with the capping of catsup bottles, wherein the bottle and cap are so constructed as to permit of the sealing by the present process in the first instance and of subsequent use of the sealing cap during the gradual using of the contents of the bottle.

WORK TABLE.—J. BUCHHEIT, 269 Powers St., Brooklyn, N. Y. The invention relates to work tables such as are adapted especially for the wrapping of heavy bundles, boxes, packages, or the like, and delivering the same therefrom to a



A VERTICAL LONGITUDINAL SECTION OF THE TABLE

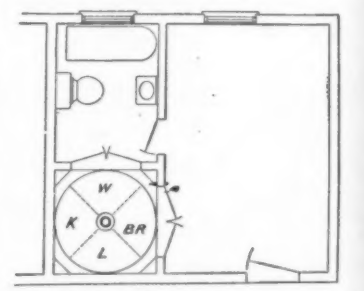
truck or other mechanical carrier. More definitely stated among the objects is to provide a work table designed particularly for wrapping of large and heavy bundles of printed or unprinted sheets of paper, although the field of usefulness is not necessarily limited in this respect.

LIFE PRESERVER.—G. BIDONDE, 520 Cottage St., Richmond Hill, L. I., N. Y. An object of the invention is to provide a simple apparatus which can be easily and quickly adjusted on the head of a person and engaged with his nostrils so that air can be received from a point above the head even if the head is partially or totally submerged. Another object is to provide a device in which the air inlet is in the shape of an air ball, therefor when the same strikes the water, water is prevented from entering therein.

PACKER'S TRUCK.—F. C. GORDON, Wenatchee, Wash. The object of the invention is to provide a device especially adapted for fruit packers, wherein the truck has a series of supports for supporting crates or boxes at a proper height for easy packing, the said support being reversible to permit the truck to be suited to a right handed or left handed person.

LACE.—G. F. SCOTSON-CLARK, 939 Eighth Ave., New York, N. Y. Among the principal objects of the invention are, to provide a permanent rigid extremity integrally connected with the body of a lace, to provide a flat terminal for shoe and corset laces, which will not separate, to form a rigid terminal for laces without altering the external appearance of the same.

REVOLVING PLATFORM FOR APARTMENT FURNITURE.—P. L. CIMINI, 47 Niagara St., Buffalo, N. Y. The invention relates to a space saving device for small apartments, forming part of the rooms, and so arranged that a room may be easily transformed into a living



PLAN OF AN APARTMENT PROVIDED WITH THE INVENTION

room with library, sleeping room, wardrobe, or kitchenette adjoining, as occasion may require. The structure comprises a revoluble platform, a tubular column, housing a standpipe, the platform being subdivided into a plurality of compartments, the standpipe having a revoluble section, a drain pipe and water supply pipe, and motion transmission means on the platform.

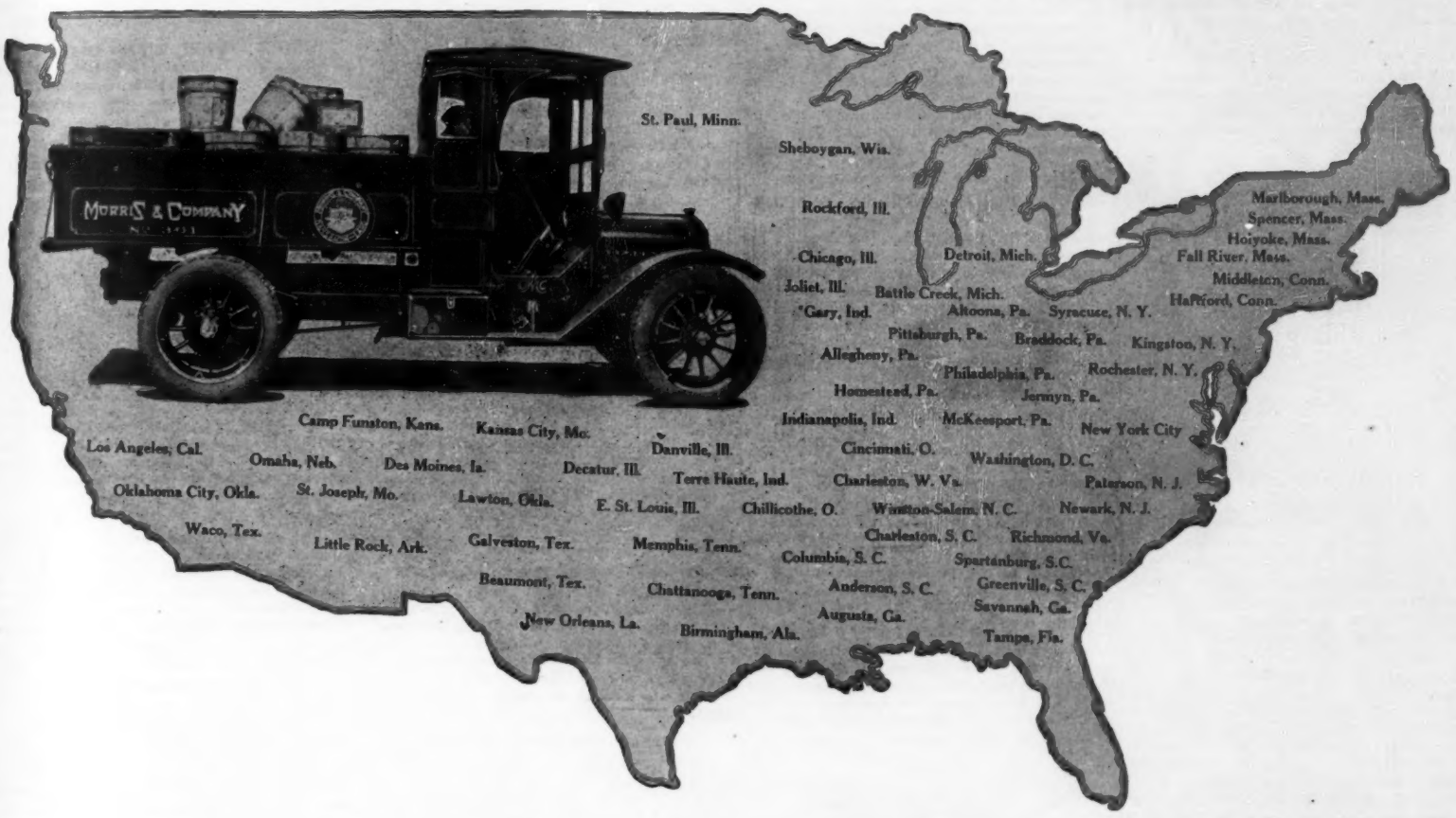
CUSHION COVER FOR FRUIT CRATES.—I. W. PECK, 683 College St., Macon, Ga. The object of the invention is to provide means in connection with the cover of a crate for permitting quick and easy attachment of a cushion to the cover, the cushion being designed to protect the contents of the crate, and made of excelsior or the like, placed between strips of paper and made fast to the cover by cleats. The cushions may be applied to the crates at the place of packing.

PRINTER'S CHASE LOCK-UP DEVICE.—R. W. HITCHCOCK, Cody, Neb. The general object of the invention is to provide a lock-up device so constructed as to effect a material saving of time, and to take the place of the wood or metal furniture now commonly used to fill the space between the job and the chase, the locking device being so designed that it will lock the job both ways and also lock it in the chase. The invention provides a plurality of cross bars with slugs loosely slidable thereon, in combination with quoins, whereby by means of the bars, slugs and quoins, a job can be easily and quickly locked.

PACKING DEVICE FOR FRAGILE ARTICLES.—E. J. TIEDE, 5411 Prospect Ave., S. E., Cleveland, Ohio. The invention relates to shipping devices to be formed from stiff paper or pasteboard and adapted for shipping eggs, incandescent lamp bulbs and like fragile articles. The

(*Continued on page 528*)

All over the United States MORRIS & COMPANY are using GMC TRUCKS



From Chicago, Where Morris & Company Put Their First GMC Trucks in Operation in 1915, The Morris & Company Fleet Has Spread to 63 American Cities

Nothing short of the very best in motor truck equipment is good enough to deliver Morris & Company's "Supreme" Hams and Bacon.

"We bought our first GMC trucks in 1915. That they have given splendid satisfaction is proven by the fact that we have bought, and are buying, them continuously."

Morris & Company
Thomas E. Wilson
General Manager.

GENERAL MOTORS TRUCK COMPANY

One of the units of the General Motors Corporation

Pontiac, Michigan

Branches and Distributors In Principal Cities

(425)

GMC TRUCKS

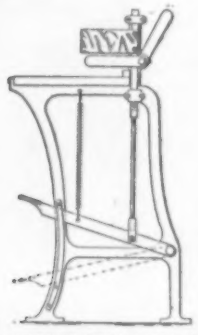
RECENTLY PATENTED INVENTIONS

(Continued from page 526)

prime object of the invention is to provide a device comprising a tubular body and separate transverse partitions adapted to be slipped into place in the body and retained in position by tongues on the tubular body, the whole being so formed and arranged that it may be packed flat to occupy minimum space.

TEMPLET FOR CONCRETE TAMPERS.—E. G. CARR, care of Lakewood Engineering Co., Cleveland, Ohio. This invention relates to concrete tampers and more particularly to the templets used in such tampers, in making concrete roads having a turn or bend in the same. An object is to provide a templet applicable for use on flat or crowned beds. A further object is to provide a templet with means for adjusting the active working edge to varying curvatures.

ICE CREAM CUTTER.—C. E. PHENICIE, 111 E. 34th St., Tacoma, Wash. The object of this invention is to provide an ice cream cutter more especially designed to cut ice cream into bricks.



SECTIONAL VIEW OF THE DEVICE

Another object is to permit of cutting the ice cream brick into slices. Another object is to insure accurate cutting of the ice cream with a view to form bricks or slices of a uniform size.

Hardware and Tools

COMBINED CLAMP AND WRENCH.—P. BOCHENEK, care of Modern Tool and Machine Works, 176 Worth St., New York, N. Y. The object of the invention is to provide a combined clamp and wrench arranged for convenient use as a hand clamp, bench clamp, monkey wrench, pipe wrench or like tool. Another object is to permit the user to conveniently hold and manipulate the clamp and wrench. A further object is to construct the tool of comparatively few parts not liable to get easily out of order.

SINK FOR SPRINKLER HEADS.—F. J. FEE, 2232 Andrews Ave., Bronx, N. Y. This invention relates to devices so designed as to operate automatically to sprinkle water for the purpose of extinguishing a fire that may have already caused sufficient rise in temperature in the building to melt a soft solder that normally holds the sprinkler in inactive condition. The device comprises a pair of metal plates forming a semi-cylindrical pocket for a cylindrical key, the key serving while the plates are united by the soft solder as a means to sustain a large portion of the stress applied to the plates.

BLOWPIPE.—E. WALDMEIER, Gulfport, Miss. This invention has for its object to provide a device wherein a nozzle is provded, having a blow tube in connection therewith and having arranged alongside a supply tube for the fuel, a check valve being arranged between the blow tube and the nozzle, and the nozzle communicating with the fuel supply by a valved communication.

AUTOMATIC SHELL TONGS.—E. E. LOFLIN, Foxworth, Miss. This invention relates to tongs for fishing or dredging for oysters, clams, or the like at the bottom of a river or other water body. Among the objects is to simplify the means for connecting the tongs, jaws or grabs to the handle, to strengthen the spring means acting upon the jaws tending to close the same automatically, to improve the latch means serving to hold the tongs open in set position, and to improve the plunger device serving to prevent the undesired opening of the tongs.

CLAMP.—W. W. ATWOOD, Tampa, Fla. The object of this invention is to provide a device especially adapted for ships carpenter's work, wherein means is provided in connection with the clamp for grasping the studding, together with a screw for forcing the plank into place, the grasping means having a double swivel connection with the clamp.

ENAMELING APPARATUS.—F. J. CARPENTER, 92 Amherst St., East Orange, N. J. Among the objects which this invention has in view are, to facilitate the handling of articles being coated or enameled, to avoid unnecessary soiling of the hands of the operator, to reduce the time devoted to distributing the coating of enamel on the article, to avoid spotting the coating during distribution, and to reduce the labor incident to the operation.

Heating and Lighting

ADJUSTABLE LIGHT FOR PROJECTION LANTERNS.—F. A. HARDYMAN, Quincy, Ill. The invention relates to adjustable lights for projection lanterns, especially those used in moving picture machines. An object is to provide a device by means of which an incandescent lamp may be used either on an alternating current or direct current system, and by means of which a saving of current is effected. A further object is to provide a device, which is capable of such adjustments that not only is the light focused on the screen, but the chromatic aberration often present when incandescent lamps are used, is eliminated.

OIL STOVE.—A. D. MULLIN, 1742 Cornwall St., Regina, Saskatchewan, Canada. The invention has for its general objects the construction of oil stoves so that with comparatively little additional expense in the manufacture and without any substantial change in the design it is possible to effectively heat a body of water while the flame is being used for ordinary purposes, the hot water heater being in the form of a jacket around the flue or burner drum, so that the heat ordinarily radiated from the drum and wasted is employed to heat the water.

Household Utilities

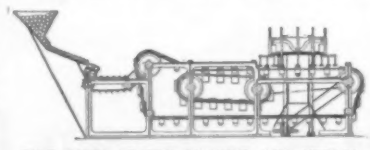
FOLDING BED.—J. E. HASSON, Northport, Ala. The object of the invention is to provide a bed especially adapted for babies, wherein the bed is connected with the bed of the mother, in such manner that it may be moved into a position at the level of the mother's bed and at the side thereof, without any obstruction between the bed and the bed of the mother, and when not in use the bed may be folded and left in suspended position supported by the mother's bed.

Machines and Mechanical Devices

ELEVATOR GATE OPERATING MECHANISM.—J. E. W. FOGAL, care of Quincy Elevator Gate Co., Quincy, Ill. The invention relates to mechanism whereby the door or gate at any floor can be opened or closed by the attendent. A more specific object is to provide one or more lifting or pick-up devices arranged on the car whereby the pressing of a button by the attendant causes an electric motor on the car to operate through a suitable winding device to first throw the pick-up device into engagement with a shaft door and then lift or move the door to open position.

SAMPLING MACHINE.—W. B. WARE, care of Southern Cotton Oil Co., Falls Bldg. 22 N. Front St., Memphis, Tenn. The invention has for its object to provide a sampling machine which will automatically take a uniform and average sample of any powdered or granulated material. The machine is provided with a sampler-wheel rotatably mounted. This wheel is provided with a pocket; when the wheel is rotated the pocket will receive the material and deposit it into a box at the bottom of the machine.

APPLE QUARTERING MACHINE.—C. KIRINO, care of Tomahi & Co., P. O. Box 418, Ogden, Utah. The invention relates to a machine for cutting into quarters or other sizes pared and cored apples for canning. A more specific object is the provision of a conveying means for the peeled and cored apples, in combination with a series of traveling tanks so timed in relation to the apple containing means that the apples will dip into the tanks, and from the tanks are conveyed to suitable cutting means whereby they are quartered by cuts coincident with the axis of the core passage.



SIDE VIEW OF THE MACHINE AND FEEDER

SAFETY ATTACHMENT FOR MOLD LINERS FOR TYPE SLUG CASTING MACHINES.—C. FADUM, 674 Warren St., Brooklyn, N. Y. Among the principal objects which the invention has in view are, to avoid danger to liners used for varying the length of the slug casting mold, to avoid delay in the operation of the machine incident to the stoppage and repair caused by damage done to to a liner, and to perfect the mechanism for arresting the operation of the casting machines when the ejectors do not correspond with the slug cast.

FRUIT GRADING MACHINE.—F. C. GORDON, Wenatchee, Wash. The object of this invention is to provide a device wherein a series of runways is provided for fruit, each runway consisting of a series of tiltable sections, adjustably counterweighted to yield under the weight of a fruit of a certain predetermined size, the device having bins for receiving the fruit, and means for quickly returning the tilting sections of the raceway to normal position.

WATER POWER APPARATUS.—F. W. INWIN, care of Morgan Bldg., Buffalo, N. Y. The invention relates generally to water power apparatus, and more particularly to an apparatus whereby to derive power from water falls, without destroying the scenic beauty of the falling water or impairing the surroundings thereof. A further object is to provide an adjustable apparatus which may be utilized beneath water falls, including rotating water wheels with which the descending water comes in contact and whereby quick adjustment may be made for high or low water supply.

WOOD TURNING MACHINE.—G. A. ENSIGN and H. D. TRAUB, care of Defiance Machine Works, Defiance, Ohio. The invention relates to wood turning machines designed for reducing a rotating stick to other than a circular cross section. The object is to provide a machine more especially designed for turning a portion of a stick to form a shank of oval cross section to form a head at one end of the stick and to provide a throat between the head and the shank thus producing such articles as spokes for use on wheels for vehicles.

CHUCK.—H. F. FOSTER, Epsom, England. The invention relates to chucks of the self-centering type. This chuck is especially suitable for repetition work where great accuracy is required such for example as in the turning of shell cases, each chuck being designed for a given diameter of shell. The invention consists in a chuck having jaws fitting within an eccentric circular cylindrical space in the chuck, the jaws being adapted to be pressed together onto the work by a wedge.

WINCH.—M. B. WILD, Birmingham, England. This invention relates to winches for use on shipboard, and particularly of the type employed for the loading and unloading of a vessel's cargo and having a plurality of drums or barrels driven from an electric or other motor constantly running in one direction. The invention comprises means for transmitting the power from the motor to the winch barrels and for control during the lifting and lowering operations.

Medical Devices

DENTAL MIXING SLAB.—S. L. JEFFERIES, Gaffney, S. C. This invention has for its object to provide a slab especially designed for mixing plastic material, the slab is so arranged that it may be used more than once without the necessity of cleaning, having two or more mixing faces, and wherein means is provided for permitting the slab to be retained at a uniform temperature during the operation of mixing.

PNEUMATIC DILATOR.—J. T. LANDIS, care of Red Star Garage, 1227 Broadway, Nashville, Tenn. The inventon relates to a pneumatic dilator, it has for its object to provide a dilator for maintaining and restoring the elasticity and pliability of the rectal muscles, when from indifference and inattention to nature's provision, they have become weakened and prolapsed, and to correct constriction.

HERNIA TRUSS.—A. T. GOOKIN, 50 Dana St., Cambridge, Mass. Among the objects of the invention is to provide a truss comprising a belt portion with an elastic connection or section serving to hold the pad or pads in place with the desired firmness but without discomfort. The device may be quickly and easily adjusted and is provided for expansion or stretching as may be required from time to time.

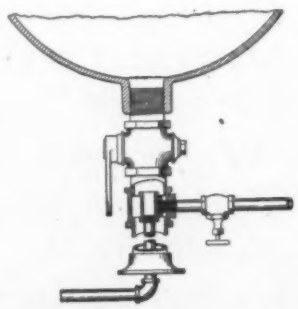
Musical Devices

TONE ARM ADJUSTMENT.—S. HECHLER, 54 Bleecker St., New York, N. Y. Among the objects of the invention is to provide a simple device whereby the counter balancing effect on a tone arm of a sound recording and reproducing instrument may be easily varied according to various types of records that are being played and without any danger of destroying the musical effect.

Railways and Their Accessories

ATTACHMENT FOR RAILWAY SWITCHES.—W. T. LAWLOR, 68 Wayne St., Jersey City, N. J. The invention relates to an attachment for thawing out snow-packed railway switches. An object is to provide an attachment which will eliminate most of the manual labor, which will permit a more uniform supply of heat and with less injury to the bed of the track. An object of the invention is to enable one man to attend to a number of switches, and also to economize fuel.

THAWING ATTACHMENT FOR DRIP PIPES.—J. E. RAY, 2131 Maplewood Ave., Apt. 3, Toledo, Ohio. The invention relates to means for thawing out drip pipes on trains, as for instance the drip pipe from the steam-heating system and from the wash bowls, etc. An object of the invention is to provide for applying the heat by a steam pipe extending centrally through the drip pipe and to subject the frozen water within the drip pipe to the direct action of the steam outside of the central pipe, by a novel arrangement the water resulting from the melting process will not be obstructed in its escape.



SECTIONAL SIDE ELEVATION OF INVENTION APPLIED TO DRIP PIPE OF A BOWL

Pertaining to Recreation

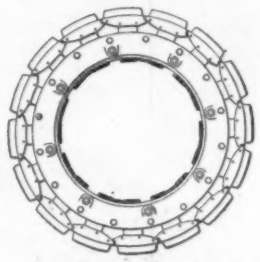
VOICE FOR TOYS.—B. E. LLOYD, 309 Jane St., West Hoboken, N. J. The invention relates more particularly to a "ma-ma" voice or other device in which a compressible element is employed for forcing air through a reed for producing the sound. A more specific object is the provision of a construction which embodies a hollow, flexible hemisphere or half of a rubber ball which forms part of the air-compressing box or bellows.

GAME APPARATUS.—G. TRIPPE, 822 Candler Bldg., Atlanta, Ga. The invention comprises a game board having a central space which is the point to be reached, a pathway surrounding the central space and sub-divided into spaces bearing names of ports of embarkation for divisions of an army, and a series of rows of spaces extending radially from the central space to the pathway bearing names indicating fortified positions to be successively captured in order to reach the central space which is indicated as "Berlin."

Pertaining to Vehicles

ATTACHMENT FOR AUTOMOBILES.—D. MCR. LIVINGSTON, 159 E. 36th St., New York, N. Y. This invention is more particularly designed for employment on an automobile in association with the masking hood forming the subject matter of Patent No. 1,156,017, granted to the same inventor, October 5th, 1915, although not limited to that particular use. The structure referred to enables stream line effects to be produced in Ford or other automobiles, the structure being such as to be free, structurally as well as esthetically from any limitations due to the character of the usual radiator or its casing.

VEHICLE WHEEL TIRE.—G. LEZCANO Y. NERRY, care of L. Iglesias, 396 Broadway, New York, N. Y. This invention relates to tires of that type in which the tread is formed by a plurality of separate tire sections yieldingly mounted on the body or frame structure of the tire. The general object is to provide a construction of tires so designed that the resiliency can be readily regulated to insure the best cushioning effect for the vehicle.



A SIDE VIEW OF THE TIRE

INNER TUBE FOR AUTOMOBILE TIRES.—J. H. HAMLIN, Winston-Salem, N. C. The object of the invention is to provide an inner tube for automobile tires composed of strips of tempered steel arranged circumferentially of the tire and secured to rings that fit within the tire, the strips being connected at spaced intervals by cross coil springs to insure the fit of the casing to the wheel.

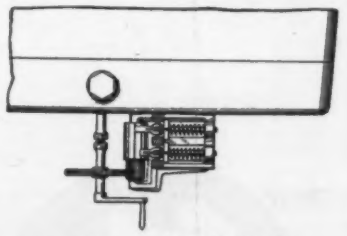
AUTOMOBILE TOP.—W. H. DOUGLAS, care of Healey & Co., 51st St. and Broadway, New York, N. Y. An object of the invention is to minimize the labor incidental to the raising and lowering of automobile tops, by the provision of operating members which are to an extent, automatic in operation. A further object is to provide means for locking the top in lowered position in a readily released manner when desired, and to provide spring means for aiding in the opening of the top into operative position.

TUBELESS TIRE AND RIM AND LOCK THEREFOR.—F. B. COMPSTON, Blooming Grove, Texas. One of the principal objects of the invention is to provide a tubeless pneumatic tire casing, and a rim and locking means therefor, whereby to draw the edges of the tire casing together to render it airtight. Another object is to provide a casing having a joint or seam upon which the pressure of the air within the casing will act to assist in retaining an airtight joint between the edges of the casing.

AUTOMOBILE HORN.—E. TESTE and E. MALIVERT, Paris, France. The invention relates to a sound generating apparatus particularly applicable to automobile horns. This sound generating device is of the vibrating apparatus type, comprising a flexible membrane caused to vibrate by the action of air or other fluid under pressure, the current of air being allowed to flow only in the form of an undulatory current.

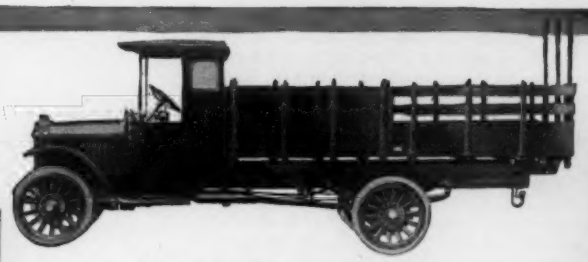
ANTI-RATTLER.—G. W. EDMONSTON, care of Baker Wakefield Cypress Co., Plattenville, La. The invention relates to anti-rattling devices for couplings and has particular reference to means for preventing rattling and excessive wear in the knuckle connecting the automobile steering arm with the transverse connecting rod associated with the steering gear. An object is to provide a U-shaped spring acting between the pivot bolt and the steering arm knuckle in such manner as to prevent rattling or unnecessary wear in connection with the bolt.

SAFETY ATTACHMENT FOR GAS ENGINE CRANKS.—M. J. REILLY, 483 Broadway, West New Brighton, N. Y. The invention relates to cranking devices for automobiles or other internal combustion engines and has particular reference to means to prevent injury to the operator at the time of the cranking operation, due to premature ignition or back-firing of the engine. Another object is to provide an attachment adapted to be readily applied to existing engines without material alteration of the structure of such engines.

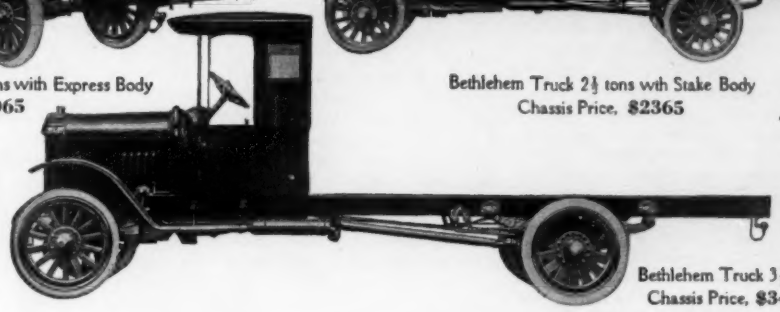


A PLAN VIEW OF THE DEVICE

Bethlehem Truck 1½ tons with Express Body
Chassis Price, $1965



Bethlehem Truck 2½ tons wth Stake Body
Chassis Price, $2365



Bethlehem Truck 3½ tons
Chassis Price, $3465

Bethlehem Trucks and Bethlehem Service Meet Export Needs

Every truck is engineer-inspected—for power—strength—endurance—

Bethlehem Trucks are fool-proof—withstand the punishment of an inexperienced driver—have an overload capacity greater than they will ever receive—

They are stronger than any road, more powerful than any grade—with stamina to go any distance.

Bethlehem Trucks embody all that is new in standard improved construction—Internal Gear Drive—Electric Starting and Lighting—Chrome Nickel Steel Construction—Armored radiator—Drive shaft steady bearing.

Whether the buyer is far or near, Bethlehem Service is maintained for him through local facilities.

The Bethlehem organization includes a complete experienced export department which handles all details of foreign orders.

Export orders receive prompt shipment. Trucks are boxed strongly and compactly to facilitate shipping and conserve cargo space.

Bethlehem Trucks arrive safely.

Write for catalog and name of nearest Bethlehem dealer.

1½ ton chassis	2½ ton chassis	3½ ton chassis
$1965	$2365	$3465

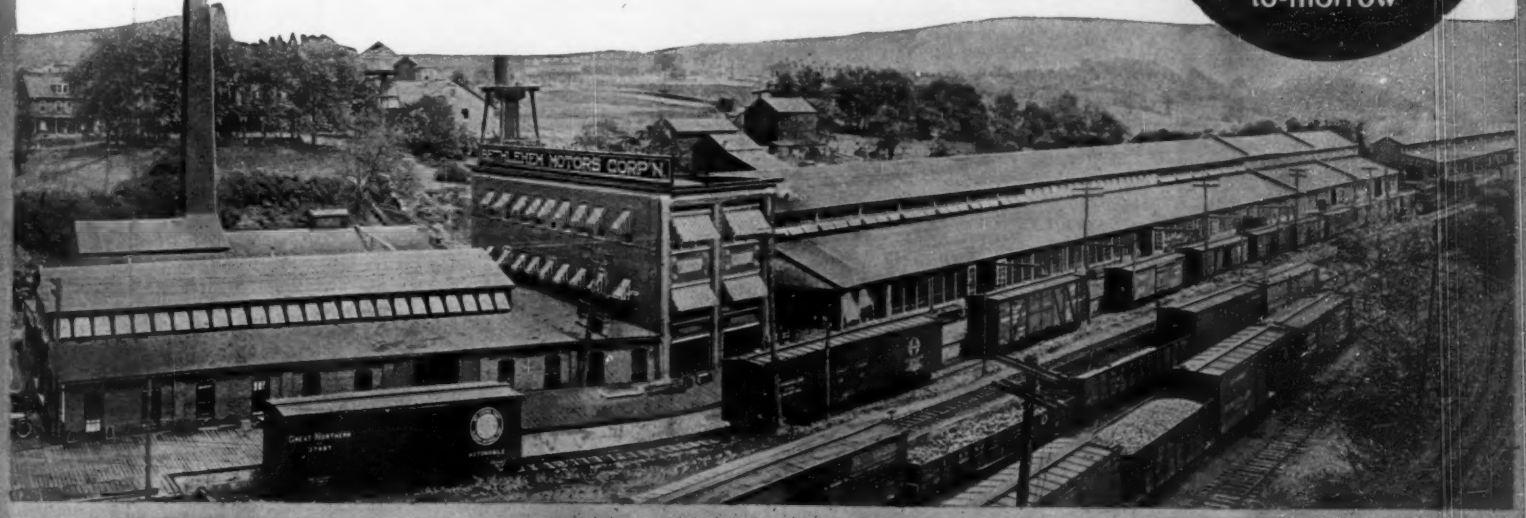
F. O. B. Allentown, Pa.

1½ tons

2½ tons

3½ tons

The Motor Truck bought to-day without Electric Starting and Lighting will be out-of date to-morrow



Built to Carry their Owners' Confidence

BETHLEHEM
Internal Gear Drive
MOTOR TRUCKS
Dependable Delivery

Will Take Your Loads Off Your Mind

BETHLEHEM MOTORS CORP'N. ALLENTOWN, PA.

CHASE

Leatherwove

"Tis like the hide in most respects
In some respects tis better"

Made by Sanford Mills

For MOTOR-CAR and FURNITURE UPHOLSTERY

THIS is the scientific fabric which the United States Government purchases for upholstery purposes. It meets every requirement of durability and appearance.

Conservation of genuine hide is necessary—to economize re-upholstering is urged. Furniture and motor cars can be readily improved by new upholstery and CHASE LEATHERWOVE is the logical choice.

FOR FURNITURE—Rich appearing—easily cleansed, sanitary, long-wearing.

FOR MOTOR CARS—Harmonious colors and patterns—weatherproof—durable.

These two grades for Upholstery:

Leatherwove Galloway
Leatherwove Gibraltar

Other grades for scores of uses.

L. C. CHASE & CO., BOSTON
NEW YORK DETROIT CHICAGO
SAN FRANCISCO
Leaders in Manufacturing Since 1947

The Current Supplement

DURING the last six months a very large amount of exceedingly valuable matter has been published in the SCIENTIFIC AMERICAN SUPPLEMENT, covering a remarkably wide range of subjects of both scientific and general information. An *index* of this matter will be found in the current issue, which appears on December 28th, No. 2243, which should be preserved for reference by everyone interested in the notable advances in world thought. An illustrated article on *Tobacco* reminds us what an essential this article has become throughout the world. This issue contains another of the popular papers on *Anomalies in the Animal World*, which is accompanied by several illustrations. *Rapid and Ultra-Rapid Tanning* reviews a number of processes in the preparation of leather, reviewing the history and progress of the art. Before the clock came into use, some curious old instruments were employed for ascertaining the time at night, and several of these are described and illustrated in an article on *The Nocturnals of the Renaissance*. Many of these were elaborately embellished by the engraver and metal worker, as is shown in the cuts accompanying the article. Other articles of interest in this issue include *The Position of Airships in the Future of Aeronautics; Lantern Slides by Reduction; Usefulness of a "Movie" Camera for Photographing Phenomena of Solar Eclipses; Statistical Studies of Dietaries* and *Copper-Base Bearing Metals*.

Some Motor Truck Economics

(*Continued from page 514*)

But the motor truck is helpless if it has no well constructed, smooth, dependable road on which to roll.

When the thousands of motor trucks in France come home again, they will spread out, fanwise, from their landing ports, presumably to go loaded with army impedimenta to storage warehouses.

They will then either be absorbed into civil (life for no matter what sort of a standing army we possess, we will not have use for the amount of trucks required for a fighting army, and it is not likely that the War Department will keep against a possible second emergency, trucks which will unquestionably get out of date and become inefficient by the standards of years to come), or be worn out in reconstruction work here in which the army will play a leading part.

That wearing out will be a short process, be the strength of the trucks what it may, if we have not some decent roads for the trucks to travel upon. That absorption into civil life will be difficult and ineffective as our roads are useless and inefficient.

Now there is no question of our ability to build roads which stand up under any truckage which may roll over them. It is only a case of readjusting our standards. At present these standards, if we have such a thing, are those of the horse drawn vehicle. For years after the invention of the motor car, we had large wheels and a right hand drive, a "fifth wheel" for steering purposes and a "dash board" (the name of which we still retain). We built our first motors to horse drawn vehicle standards, just as the first railroad carriage were stage coaches on rails. But while we have widened the roads and eliminated the dust with oil and tar, we still build to horse drawn vehicle standards—small loads, weak foundations and curves wherever the nature of the terrain indicates.

Railroads for years found it more economical to build curved tracks than to cut, bridge or tunnel. But increasing use has demonstrated that the straightest track is the least expensive in the long run, be its cost of construction what it may.

We must come to a similar standard for intercity roads, if not for feeder roads from smaller, less populous localities. Railroads now know that there is only one form of track worth building, and that is the one which lasts the longest. We must come to a similar standard in road building.

We have accustomed ourselves for years to think of good roads as meaning from $5,000 to $20,000 a mile, largely according to width. We must come to the standard of the railroad, which puts down a mile of track to stay down and *do the work*, and considers the cost afterward.

The future may hold some revolutionary form of road building of which the present has no idea. Until that revolutionary material or process arrives however, we must plan to build our roads with the materials we have and the processes we know. There is no question but that a rock foundation of a sufficient thickness, a road bed of a sufficient width, and a concrete surface (perhaps protected with an earth cushion, perhaps bare), can be put together to stand any quantity of motor truck trains of any weight and speed. But it can not be done for $5,000 a mile. And it cannot be done effectively by various localities.

We have 48 states with 48 standards of road building. We have 48 road commissions or boards or other bodies, all too frequently political in character. What we need for roads is what we have now for railroads—governmental control. The railroads worked out a standard track for themselves from sheer necessity (and what a pity it was the track of an originally ox or horse drawn cart!) The railroads met the need because a railroad was not only track but vehicle, and inter-use required a standard. The road, wherever it comes from, individual locality or central government, is usable by vehicles of any width, any size, any ownership. There has never been the need of standardization which the railroads felt. And so we have gone on from bad to worse, each state, each county, each township building what it saw fit, when it wanted to, where it felt the road should go, and whatever kind of road its best engineering talent or its worst political advice happened to recommend!

As a result we have more than 2,300,000 miles of road, about 10 per cent improved, and of those 10 per cent, not 1 per cent fit for continuous use by the greatest transportation factor developed since the invention of steam—the motor truck!

We have at present a large number of huge factories doing nothing but turning out motor trucks of all kinds and sizes. They have been engaged in supplying the army first, and the civil business demand when they have any spare time and material. When peace comes and the army need for trucks and more trucks and still more trucks abroad ceases, those factories are going to do one of two things—either they are going to keep on making trucks, or they are going to cease making trucks and turn to making something else.

There is a decided and well visioned limit to the ability of the business of the United States to absorb motor trucks. That limit is sharply set by the available roads over which trucks can run. It may seem a far distant limit, but it is absolute. When all the businesses which can operate on roads able to stand truck use are supplied, there can be no more demand for trucks, save the replacement demand. With less than 1 per cent of our millions of miles of roads improved to the point where any truck can use them at any time without damaging them, that limit may not be so far in the future.

Last winter a brand new experiment was tried—first in Connecticut, later in other states—keeping roads free from snow. Prior to that time no one ever thought of doing for the country road what cities always did for their streets. But the motor truck, particularly where many munition factories were pouring material to the sea board, at a rate far exceeding the railroad car capacity, was too absolutely an essential to be eliminated merely because of winter conditions. It was found perfectly possible to clear roads even of heavy snows, by the use of heavy duty trucks equipped with snow plows and scrapers. The matter is important, because the more use there is for a road, the less its cost per hour of existence. Hitherto even a fine road was of little service in bad winter weather. With the motor truck coming into its own, such snow clearing will not only decrease the unit cost of roads to the taxpayer, but vastly decrease the overhead of truck ownership and operation.

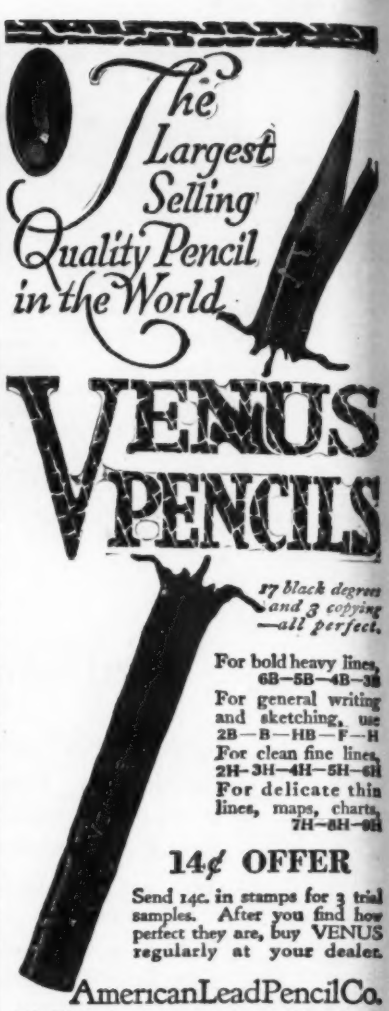
In spite of the intense local interest which most Americans take in politics, we have yet to take our government seriously from the commercial standpoint. Only in recent years have we begun to experiment, and some of those experiments have been more disastrous than helpful—*vide* 48 varieties of legislation affecting railroads, plus a federal control which finally threw the roads into such a state of chaos that the government had to take them over. But out of chaos comes order. Is it not at least possible that we realize the need now, rather than after the emergency is full upon us, and so do something in the immediate present towards visualizing the necessity for national roads for the benefit of the nation and the nation's trucks?

The problems of reconstruction are many and great. The United States has taken upon itself a burden of taxation which is huge in amount and in possible extent. We need to make all the money we can,

(*Continued on page 532*)

The Largest Selling Quality Pencil in the World

VENUS PENCILS



17 black degrees and 3 copying —all perfect.

For bold heavy lines, 6B—5B—4B—3B
For general writing and sketching, use 2B—B—HB—F—H
For clean fine lines, 2H—3H—4H—5H—6H
For delicate thin lines, maps, charts, 7H—8H—9H

14¢ OFFER

Send 14c. in stamps for 3 trial samples. After you find how perfect they are, buy VENUS regularly at your dealer.

American Lead Pencil Co.
217 Fifth Ave., New York
Of all stationers and stores throughout the world

NOBODY ever changes from Rameses

The Aristocrat of Cigarettes

Why?

STORAGE BATTERIES SIMPLIFIED

A comprehensive treatise devoted entirely to secondary batteries and their maintenance repair and use

This is the most up-to-date book on this subject. Describes fully the Exide, Edison, Gould, Willard, U. S. L. and other storage battery forms in the types best suited for automobile, stationary and marine work. Nothing of importance has been omitted that the reader should know about the practical operation and care of storage batteries. No details have been slighted. The instructions for charging and care have been made as simple as possible. 250 Pages. Very Fully Illustrated.

Price **$2.00** By mail **$2.15**

Books sent prepaid to any address on receipt of price

MUNN & CO., Inc.
Woolworth Bldg., 233 Broadway, New York

FAFNIR

Conservation and Ball Bearings

The conclusion of four years of war must inevitably be followed by a period of intense reconstruction. Consequently, the elimination of unnecessary bearing friction and the utmost conservation of power are more imperative at this time than ever before.

This situation makes the extensive use of ball bearings in all types of mechanisms, from motor cars and tractors to machine tools and line shafting, even more essential than in the past.

THE FAFNIR BEARING COMPANY

Conrad Patent Licensee

New Britain, Conn.

CHICAGO Office: 1919 So. Michigan Avenue
DETROIT Office: 752 David Whitney Building

To anyone interested in ball bearings, we will be glad to send a copy of each issue of our monthly publication "THE DRAGON."

Better and Cheaper than Sawtooth

Sawtooth roofs are good for narrow buildings, bad for wide ones.

They do not ventilate the center spaces: the wider the building the larger the "dead" area.

They give a one-direction light, with unpleasant contrasts for anyone facing north.

The modern lighting and ventilating roof is the

Pond Truss
PATENTED
THE ROOF THAT VENTILATES

It utilizes the natural air movements in a wide building.

It gives an all-directions light, without shadows or glare.

It does both at less than sawtooth cost.

A notable Pond Truss building is here shown. Between the outlet lines of Pond Continuous Sash are other lines admitting both light and air while excluding rain.

All the roof sash are operated by electric motors in lines hundreds of feet long.

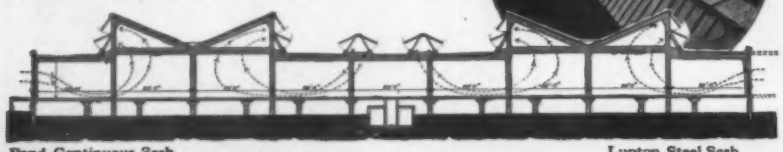
The Pond Truss represents the best possible use of top-hung, weather-proof POND CONTINUOUS SASH. It permits one-story factory buildings to be made of any desired width and length, without the drawbacks of ordinary roofs. It is patented, and its use is licensed where Lupton Products are used in the same building.

Booklet, "Air, Light and Efficiency," tells more about Lupton Service and Products.

DAVID LUPTON'S SONS COMPANY
Clearfield & Weikel Sts. Philadelphia, Pa.

The Government has lifted all restrictions on steel sash and other building materials. Build now!

Illustrations show main manufacturing building of Dayton-Wright Airplane Co. Messrs. Schenck & Williams, Architects. Size, 270 x 1000 feet. Will eventually be 870 feet wide. Roof has two Pond Trusses, with Pond A-frames between. Pond Continuous Sash used in all roof openings.



Pond Continuous Sash for Pond Truss, sawtooths, monitors and side walls
Pond Operating Device for long lines of sash
Lupton Rolled Steel Skylight

Lupton
INVESTMENT VALUE

Lupton Steel Sash
Pivoted Factory Type
Counterbalanced Type
Counterweighted Type
Lupton Steel Partition and Doors

Just Published!

Wireless Telegraphy and Telephony

Simply Explained By ALFRED P. MORGAN, Wireless Expert

170 Pages 156 Illustrations Cloth Bound

Price $1.25; by mail, $1.30

The simplest, latest and most comprehensive popular work published on wireless, for the wireless operator, amateur or professional

THIS is a comprehensive treatise and a close study of its pages will enable one to master all the details of the wireless transmission of messages. The author has filled a ong-felt want and has succeeded in furnishing a lucid, comprehensible explanation in simple language of the theory and practice of wireless telegraphy and telephony.

The book treats the subject from an entirely new standpoint. Several very novel and original ideas have been carried out in its making. It is well illustrated by over one hundred and fifty interesting photographs and drawings. All diagrams have been made in perspective showing the instruments as they actually appear in practice. The drawings are carefully keyed and labeled. Many of the photographs are accompanied by phantom drawings which reveal the name and purpose of each part.

This is a book the wireless experimenter cannot afford to be without. It enables one to design and construct their own apparatus. This book will also prove of value to the layman.

MUNN & CO., Inc., Publishers 233 Broadway, New York, N. Y.

Some Motor Truck Economics

(*Continued from page 530*)

develop all the industries we can, utilize our resources to the fullest extent. It is a business axiom that one has to spend money to make money. Is there any better way to invest some of our governmental appropriations than in a real, a comprehensive, a constructive road problem solution, instead of leaving it, as we have hitherto, to be, like the tariff, a strictly local issue?

This does not mean the legislator, the judge, the Senator, the high official. It means the voter, the manufacturer, the truck user. It means each and every one of us who is at all interested in transportation in order to make money. And the one and the only way in which we, each one of us, can help settle this question is to take it into politics and demand from our representatives some consideration of the fact that modern transportation problems need the motor truck for a solution, that the motor truck is useless without adequate roads and that only a governmental standard and governmental supervision can make our road system adequate.

The Truck Triangle

(*Continued from page 516*)

hire of a truck driver will continue, however, and therefore such a truck represents a direct liability during the time that it is indisposed.

It will be seen from this that the matters of adequate service and ease of securing necessary spare parts are as important in the selection of a truck as is correctness of design, or mechanical excellence—more necessary, in fact, for the strongest truck made may be injured in an accident and kept out of commission for as long a time as is required to secure the necessary replacement, while, on the other hand, a poorly-designed truck may be patched together and kept in some sort of running condition provided duplicates of those parts which may break down and wear out are immediately available.

The time during which a truck is laid up for overhauling or repairs, as indicated on the cost-keeping chart, may represent the key by which an installation may be transformed from a loss to a profit. The truck owner who obtains the most from the investment must consider well the advantages to be obtained from the maintainence of a private repair department and balance this added cost against the service available from the local garage. As a rule, it is generally considered inadvisable for the owner of fewer than four or five trucks to maintain his own repair department. Local conditions, however, may indicate that in certain installations an additional salary of $5 or $10 a week, paid for a driver who is a thorough mechanic and repair man as well as a chauffeur, will save costly delays and inefficient work in the repair department of the local public garage.

If a truck owner so intensifies his delivery system that it is operated to its maximum efficiency, it may be argued that this side of the triangle will be so extended as to destroy its equilateral nature. If this occurs, the obvious remedy is the purchase of a new truck of such proved efficiency that it cannot serve to limit the effectiveness of the delivery system. When such a condition exists the old truck will have been proved to have been a liability rather than an asset and the cost of the new vehicle will be more than defrayed through the saving in operating expense and the increased business possible through the lengthening of all three sides of the triangle—it being assumed, of course, that the driver has shared in improving the effectiveness of the delivery system and that his side of the triangle automatically grows with the other two.

The Trend of Tractor Development

(*Continued from page 516*)

sold are equipped to use the heavier fuels and in many cases the manufacturers make broad claims as to the satisfaction they will afford with such fuels; yet it is a matter of common knowledge that not all farmers are able to obtain the results claimed, and there are manufacturers marketing kerosene-burning engines who state frankly that they are not yet satisfied but are working toward better results. The chief troubles are the accumulation of carbon in the cylinders and passages and on the valves and piston heads, and the condensation of the kerosene) which runs down and mixes with the lubricating oil, thinning it, in time, to a point where its value as a lubrication is more or less seriously impaired. A great deal of progress has been made, however, and in a good kerosene-burning tractor the accumulation of carbon and the thinning of the oil are so slight as to be more than offset by the fuel economy; while good engine construction greatly facilitates cleaning out, and changing the oil at fairly infrequent intervals is not a serious matter. In all cases the engine is started and warmed up on gasoline and then switched over to kerosene; in the average three-plow tractor it is not usually necessary to use more than two or three quarts of gasoline a day if the operator is moderately competent. Usually the consumption of heavy fuel exceeds that of gasoline by from 10 to 15 per cent, which is not much compared with the wide difference in prices. In practically all cases where kerosene is employed, heat from the exhaust is used to effect vaporization.

Perhaps there is no phase of tractor engineering that admits of such wide variety as the means for obtaining traction. There are tractors with one, two, three and four driving wheels; tractors with one and with two crawlers or chain treads; tractors with front-wheel drive, with rear-wheel drive and with both front and rear drive; tractors with no wheels, but with all the weight resting on the crawlers; tractors with crawlers in the rear and tractors with the crawlers in front; even tractors with a single front-drive crawler. The four-wheel tractor with rear-wheel drive is in the majority by a considerable margin, but the advantages of the other types are being brought out by practical work and are being almost constantly improved.

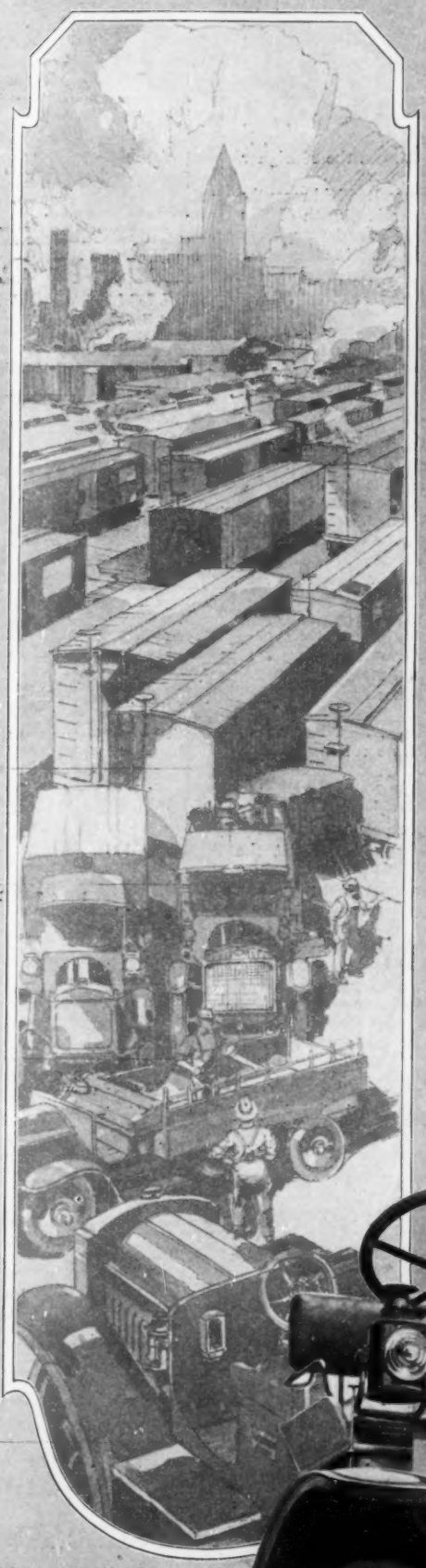
There is no one type, apparently, that embodies all the advantages—which is entirely natural. The track-layers have the advantage that they have very little packing effect on the soil, in some cases the ground pressure being as low as 3½ pounds per square inch. Some of these machines will do effective pulling on swampy ground and, in one instance at least, crawlers are used for hauling loads over surfaces consisting of smooth steel plates—this in an industrial plant where the machines are used in hauling materials from one building to another. A criticism of the crawler is that the chain tread, or plate tread, is entirely open to dust and dirt, cannot be protected, so that under some conditions the wear at the joints and other parts is rapid. The wheel tractors find difficulty in negotiating very soft land, but seem adapted to most of the ordinary conditions that obtain in farming, and where four-wheel drive is used some of the most remarkable results have been obtained.

The track-layer with a single track at the front is an exceedingly mobile machine, being capable of turning at right angles and maintaining its effectiveness in pulling, as the pull is always in the direction of movement. Tractors having a single very wide drum or three wide wheels, instead of two rear driving wheels, are designed to combine as far as possible the advantages of both wheel and crawling drive.

Final drive in the case of wheel-driven tractors is something that still needs a real solution. Most rear-driven wheel tractors adhere to an old plan of using large bull gears on the rear wheels, with drive from pinions on a countershaft which forms the last link in the gearset. Full protection of these gears and pinions seems practically impossible, and it is customary to make provision for easy replacement. In some cases cast steel gears are used with uncut teeth, while in other cases the teeth are machined. High-grade hardened steel roller chains and steel sprockets are used in not a few instances, and with excellent results; but protection is as difficult as with the gear drive. In a number of instances the final drive takes the form of a worm- or gear-driven live rear axle. This method appears to have promise, as it is one that has had a great deal of development already. The enormous gear reductions necessary in tractor work, however, make it necessary to use exceedingly strong construction. When it is remembered that the full power of an engine developing, say, 25 horse-power, is applied to the axle through a gear reduction which gives the tractor a working speed of about 2½ miles an hour, or, for emergency work, as low as 1½ miles an hour, it is apparent that the axle and gears must withstand stresses that are enormous and, moreover, are practically constant while the tractor is at work.

Among the refinements that are being adopted by tractor designers ball and roller bearings are conspicuous, and it has been found that under proper conditions these

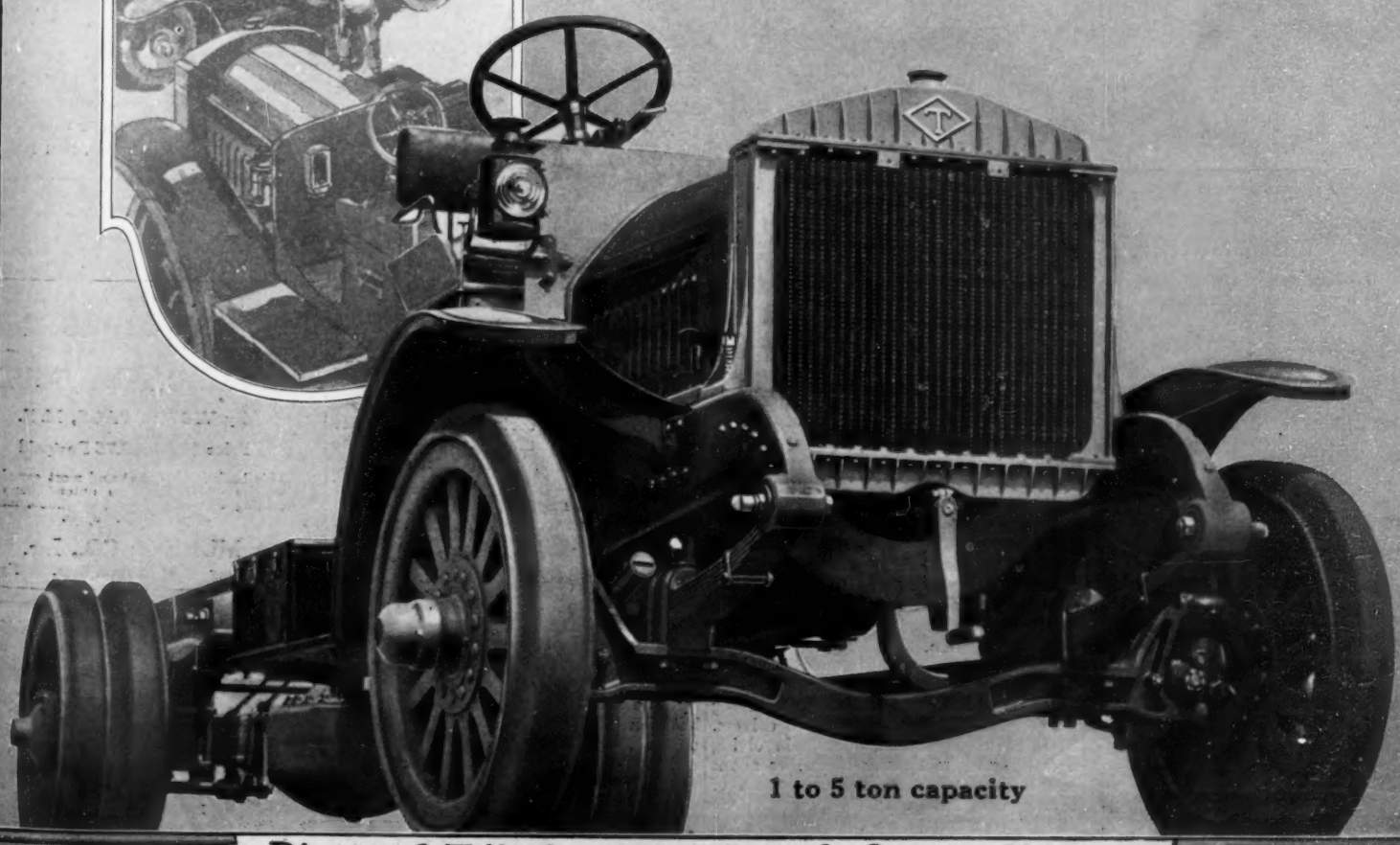
(*Continued on page 534*)



DIAMOND T

"A good name is rather to be chosen than great riches." The name DiamondT was first chosen and then established by unfailing service.

DIAMOND T
THE NATION'S FREIGHT CAR

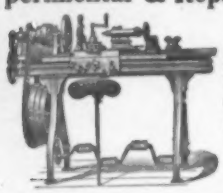


1 to 5 ton capacity

Diamond T Motor Car Company 4521 W. 26th Street, Chicago

LATHES AND SMALL TOOLS

For Gunsmiths, Tool Makers, Experimental & Repair Work, etc.



From 9-in. to 16-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

W. F. & J. Barnes Co.
Established 1872.
999 Ruby Street
Rockford, Ill.

SOUTH BEND LATHES
Established in 1906 Over 19,000 South Bend Lathes in use

For the Machine and Repair Shop
LOW IN PRICE
12 in. to 24 in. swing
Straight or Gap Beds
Send for free catalog giving prices on entire line
South Bend Lathe Works
421 Madison St.,
South Bend, Ind.

ECONOMY renewable FUSES

Replace the Link—Renew the Fuse

cut annual fuse maintenance costs 80%. Can be used over and over. An inexpensive "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency.

ECONOMY FUSE & MFG. CO.
Kinzie & Orleans Sts., CHICAGO, U.S.A.
Sole Manufacturers of "ARKLESS" the Non-Renewable Fuse with the 100% Guaranteed Indicator.
Also made in Canada at Montreal

SOLVINE BOILER PRESERVER

Warranted, without reserve, to remove boiler scale, prevent pitting and scale formation.
Pamphlet on request. Money back guarantee.

EUREKA MFG. CO. - - Jersey City, N. J.

MODELS CHICAGO MODEL WORKS 166 W. MADISON ST. CHICAGO, ILL.
ESTABLISHED 1867 WRITE FOR CATALOGUE OF MODEL SUPPLIES

THE BRIDGEPORT CHAIN CO.
Specialists in Small Wire Shapes & Flat Stampings
Bridgeport, Conn.

TELESCOPES CATALOGUE W. & D. MOGEY PLAINFIELD, N.J.

RAISE BELGIAN HARES For U.S.

HUGE PROFITS easily and pleasantly made. We furnish stock and pay you $6.00 a pair and express charges for all you raise. Contract and book "Fortunes in Hares," 10c. Nothing free.
NATIONAL FOOD & FUR ASSOCIATION
Dept. 87 MILWAUKEE, WISC

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery
The VILTER MFG. CO.
899 Clinton Street Milwaukee, Wis.

Manufacturers, Stimulate the inventive faculties of your Engineers and Mechanics

by making available to them a complete set of all patents — properly classified—which relate to your particular line of work. The results will surprise you. We can furnish such sets of patents in convenient form for ready reference. Write our Manufacturers' Service Department.

Scientific American
ROOM 676
Woolworth Building New York, N. Y.

The Trend of Tractor Development

(*Continued from page 532*)

have proved very effective in reducing friction losses and increasing durability. Many tractors are fitted with such bearings wherever it is possible to use them. On the other hand, not a few tractors use babbitted bearings almost entirely, some of these being exceedingly large. One machine, for instance, has a 3-inch rear axle running in babbitted bearings 15 inches long. Electric starting-lighting equipment has found a place, though not as yet a very conspicuous one. The lighting feature is a good one, however, for it permits good work to be done at night, and where there is a lighting generator and a storage battery it is but a short step to a starting motor. There is one tractor on the market in which an eight-cylinder engine is used.

Ability to travel over very uneven ground is essential, and in the track-laying machines this is obtained by hanging the chain-carrying frames on independent pivots, so that each can move as the nature of the ground demands; the chain itself is more or less flexible, usually deflecting from a straight line against spring pressure. In the four-wheelers the front axle is commonly pivoted at the center so that one wheel can rise much higher than the other without affecting the stability or the position of the machine as a whole. The three-wheelers are inherently stable and do not call for special construction, though if not carefully designed, with due attention to weight position and distribution, they are likely to be rather easily overturned.

The matter of weight distribution is an important one. With the low weights that now prevail it is necessary to get as much on the drivers as possible. Yet there must be sufficient weight forward to counterbalance the tendency of the tractor to rear up on its hind wheels when making a hard pull. Tractors exist that must be a little carefully handled when starting with a good load in order to keep the front end on the ground. The hitch or plow drawbar is an important factor here, for if it is not properly placed the rearing tendency is increased. In some tractors the hitch is forward of the rear axle and more or less toward the front, and in one case, and possibly others, it is at the extreme front end, so that the rearing tendency is almost nullified.

It is evident from a necessarily incomplete review of the great variety of sometimes contradictory features of the tractor of today that the future may be expected to bring something in the way of elimination and something in the way of wider adoption of some forms of construction. At the same time the conditions under which tractors are used vary so greatly that considerable variation in the tractors themselves will always be required. The tractor cannot be compared to the truck in this respect. Truck operation presupposes a reasonably good road, and part of the work of improving trucking consists in improving the roads. The tractor, however, has to take the ground as it comes, and it must be built accordingly.

Motorizing the Mails

(*Continued from page 518*)

reasonable cost for carriage, thus relieving other congested avenues of transportation and preventing wastage at the farm, thereby conserving perishable food products, encouraging increased production, at the same time insuring a reliable market to the producer and giving the consumer the advantage of better and fresher produce at less cost.

"It is intended ultimately to extend these trunk line routes to the Pacific Coast and connect them with feeder or lateral routes from contiguous producing territory. Owing to the limited appropriation it will hardly be possible to do more this fiscal year than connect up the routes in Ohio with those terminating at McConnellsburg, Pa., to extend the service south from Louisville, possibly to New Orleans, and thence connecting up with the service in Gerogia, and also connecting with the service now in operation southwest from Washington.

"On the 15 routes now in operation there are employed 60 trucks of from one to one and a half tons capacity, including reserve trucks, together with 50 drivers. These routes cover 2,311.06 miles involving a daily travel of 2,622.20 miles, or about two million miles per annum. Some of these routes have been in operation long enough to demonstrate that they are not only self-sustaining but are actually large postal revenue producers. A tabulation of receipts and operating costs for eight of these routes for the first five months of this year show gross receipts of $152,237.74 with operating expenses of $27,130.98, a net profit of $125,069.40, an average of about $3,000 per route per month.

"The service which it is proposed to give is similar to that afforded by commercial express trucks, within the limit of weight prescribed by law; that is to say, 70 pounds for a distance of 300 miles from the point of mailing, and 50 pounds beyond 300 miles. Commodities such as eggs in crates, butter, crates or baskets of fruit will be accepted if presented just as they usually are for shipment by express, and, where the size of a shipment warrants, it will be delivered direct from the consignor to the consignee."

Secretary of Commerce Redfield recently asserted that the economic growth of this nation depended upon the development of highway transportation to the same extent that railroad and waterway systems are utilized. The fulfillment of the plans of the Post Office Department will go a long way toward bringing the highways back to the same importance that they had prior to the advent of the railroad. In transporting mail matter in great volume over the highways, the Post Office Department will stimulate rather than limit the development of other motor vehicle services. Furthermore, by taking over a considerable part of the great motor vehicle equipment now owned by our army, and thus preventing its sale under the hammer, the Post Office Department will render a real service in stabilizing conditions in the motor truck manufacturing business.

In conclusion, the taking over by the National Government of many of the main trunk highways, will enable the states to expend more money on state roads, after which will follow as a natural sequence the connecting up of town and country, then county and county, thus facilitating inter-state and intra-state communication.

Post-War Status of Motor Truck Industry

(*Continued from page 520*)

knowledge of military matters, that the trucks now in France will be needed there and will never be brought back; in fact, they believe more trucks will be required there for feeding the populations not only of the invaded countries but of the central empires as well, and also for the extensive resonstruction work that must be done quickly. It is not to be overlooked that the European railroads, particularly in Germany and Austria, are in a deplorable state of inefficiency and that the populace will be, to a great extent, dependent on transportation by highway. An inkling of the great need for motor truck transportation was given by the clause in the armistice calling for delivery to the Allies of 10,000 trucks by Germany and the reduction of this figure to 5,000 upon the representations of the Germans that the trucks could not be spared, as Germany required them herself to meet urgent civilian requirements.

Fourth Assistant Postmaster Blakslee has announced that the Post Office Department will be able to use thousands of the army trucks on rural parcel post routes which it is establishing in many parts of the country. It is said the Post Office has already told the War Department it could use 17,000 army trucks and chauffeurs on postal routes but has been advised the army could not let it have more than 5,000 trucks. The Post Office Department has linked Boston and New Orleans with a complete chain of motor postal routes and has made plans to gridiron the whole country with similar service. These routes handle all sorts of farm produce and packages of merchandise from the cities, newspapers, periodicals and first class mail. They have proved very profitable to the Department and given the public a daily service surpassing anything heretofore had.

There is no doubt that the trucks of 1½ to 3 tons capacity purchased by the army would be suitable for this work, if the War Department finds it can release any large numbers of them. Even the standardized B military trucks, purchased in great numbers, might be used advantageously by the Post Office for transfer work between the general and branch post offices and the railroad stations in the cities. These trucks are held by engineers to be overpowered and too heavy for economical operation in ordinary commercial service, but the Post Office has no competitor and the price at which it

(*Continued on page 536*)

LEGAL NOTICES

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to *Patents, Trade Marks, Foreign Patents,* etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & CO.
SOLICITORS OF PATENTS
233 Broadway, Woolworth Building
New York
And 625 F Street, Washington, D. C.

Annual Subscription Rates
Scientific American Publications

Scientific American (established 1845) one year $5.00
Scientific American Supplement (established 1876) one year 5.00

Postage prepaid in United States and possessions, Mexico, Cuba and Panama

Foreign Postage

Scientific American $1.50 per year additional.
Scientific American Supplement $1.00 per year additional.

Canadian Postage

Scientific American 75c per year additional.
Scientific American Supplement 50c per year additional.

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Classified Advertisements

Advertising in this column is $1.00 a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

FOR SALE

PRACTICAL labor saving device, that has been thoroughly demonstrated, and has passed the experimental stage. Now being manufactured by the patentee. We invite rigid investigation. Satisfactory reasons given for wanting to sell. Device—Box 773—City Hall Station New York City.

PATENTS FOR SALE

TO settle estate, Tvedt's Adjustable Mufflers for sale. Product of experience. Past experimental stage. Consult Thos. T. Tvedt, 366—53d St., Brooklyn, N. Y.

BUSINESS OPPORTUNITIES

FOR sale or to let on royalty. Incubator tray patented November 5, 1918. With this new tray the eggs are conveniently turned without disturbing the heat. Practically self turning. Any number of eggs may be turned instantly. I wish to hear from manufacturers who mean business. Address Harvey Sugg, Ladysmith, Wis.

AUTOMOBILE SPECIALTIES WANTED

WE desire to hear from individuals or concerns who have a patented article or a patentable idea pertaining to the automobile industry.

Our selling organization can profitably handle additional accessories at this time and we are in a position to manufacture, advertise and sell an article that fits in with our line.

Write fully. We will tell you by return mail if we can use your device.

F. O. B. Mfg. Co., Sales Offices, Real Estate Trust Building, Philadelphia, Pa.

SCIENTIFIC BOOKS FOR GIFTS

"EXPERIMENTS" is a handsome illustrated 264 page book by P. Edelman covering modern science wonders, laboratory stunts, and research information. Guaranteed satisfactory. $1.50 postpaid. Edelman Publisher, 1802 Hague Avenue, St. Paul, Minn.

The Modern Gasoline Automobile

By VICTOR PAGE, M. E.

Price $3.50; $3.75 Postpaid

This book is the latest and most complete treatise on the gasoline automobile; embracing its construction, operation, maintenance, and repair.

MUNN & CO., Inc.
233 Broadway Woolworth Bldg. New York

PICK, SHOVEL AND PLUCK

Further Experiences "With the Men Who Do Things." By A. Russell Bond. 5¼x8¼ inches. Cloth. 255 pages. 110 illustrations, including 58 page-plates and colored frontispiece. $1.50, postpaid $1.65

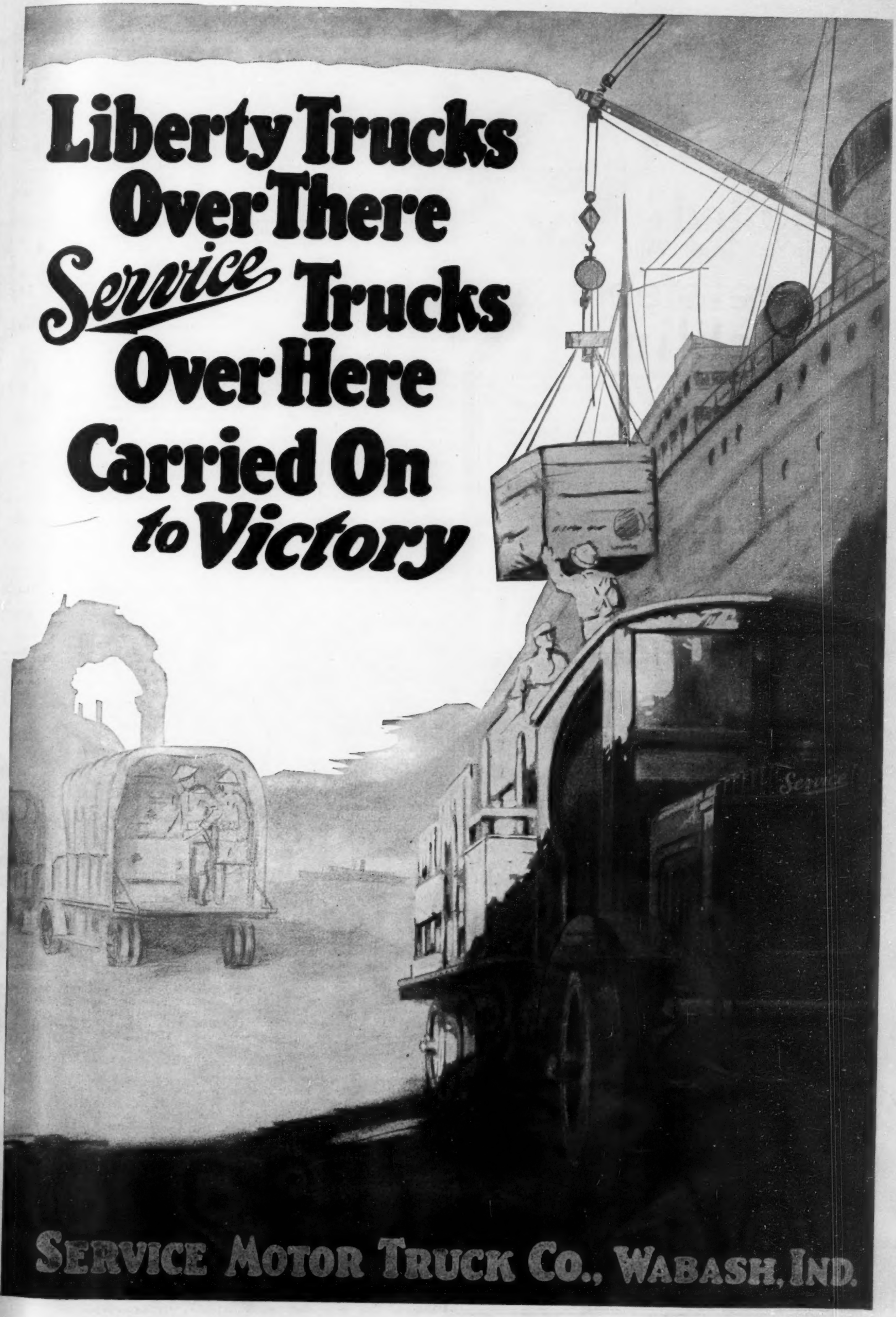
A companion volume to "With the Men Who Do Things," taking the same two boys through a new series of engineering experiences. A fascinating and instructive book for boys, relating how many big things in engineering have been accomplished.

MUNN & CO., Inc.
Publishers
Woolworth Building New York City

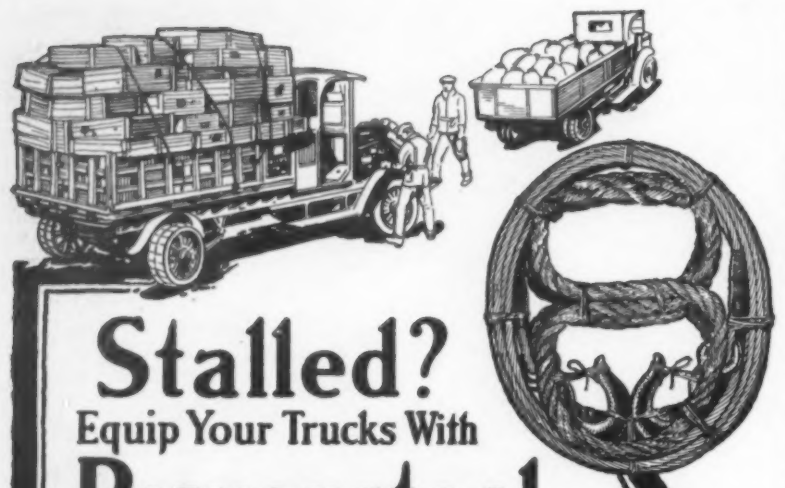
Liberty Trucks Over There

Service Trucks Over Here

Carried On *to Victory*



SERVICE MOTOR TRUCK CO., WABASH, IND.



Stalled?

Equip Your Trucks With

Powersteel Truckline

a steel-strong wire towline designed especially for heavy towing. Keeps your truck, or fleet of trucks, *always* moving—saves time and money.

Powersteel Truckline is about 18 feet of ½-inch Yellow Strand Wire Rope—the B. & B. rope that's been identified with nearly every big engineering project during the last 43 years. Has a rated breaking strain of nearly 12 tons—yet it's light, coils up compactly and takes up practically no room. Attaches quickly and surely with strong drop-forged hooks and stout manila slings.

Get Powersteel Truckline at your Service Station—or write us direct.

B. & B. WIRE ROPES are the Product of nearly a half-century's experience. They are steel-strong, elastic, flexible, durable. Always give long, satisfactory service — which means most economical service. There's a B. & B. rope to fit *your* needs. Specify B. & B.

BRODERICK & BASCOM ROPE CO.
Saint Louis, Missouri

Branches: New York and Seattle
Factories: St. Louis and Seattle

A21

Published Dec. 2, 1918

96-Page

Catalogue

of

Scientific and Technical

BOOKS

Listing 2500 titles on 500 subjects

SELECTED from more than 7,000 books now in print. This catalogue is the latest and best list of technical and scientific literature which can be secured. Conditions in the publishing business are so severe that it is with some difficulty that many books can be obtained. For which reason this new and timely catalogue of books will be particularly welcome.

Write to-day for your copy. Sent free on application

MUNN & CO.

233 Broadway, Woolworth Bldg., New York, N. Y.

Post-War Status of Motor Truck Industry

(*Continued from page 534*)

could obtain them from another branch of the Government might warrant it in using them. In fact, it might be excellent policy for the Post Office Department regularly to employ, as a matter of national policy, a standardized type of truck suitable for military purposes, which could be turned over to the army for immediate use in event of hostilities, to be replaced by the Post Office for its own use by direct purchases from the truck manufacturers, accepting in such case their regular commerical models. This would expedite the war program and enable the manufacturers to get into large production on Government orders without the unavoidable delays incident to conversion of their facilities to standardized models.

Another suggestion as to disposition of the army trucks and one that has much merit, is that the Government loan or rent them to state, county and municipal governments, for use in road construction and repair. Highway work has been suspended to a great extent during the war and particularly during the last year, when the Capital Issues Committeee refused many applications for permission to issue bonds for highway construction and the National Highways Council declined some requests for approval of construction and repair projects. The most serious interference with highway work was caused by the embargo placed by the railroads on the use of open cars for hauling road materials and machinery. As a result, the main highways, which were called upon to bear enormously increased traffic, deteriorated rapidly and excessively, so that now, with the embargo off and the need for making application for approval of improvement projects removed by the Highways Council, it is of utmost importance that road work be renewed speedily and extensively to facilitate and cut down the cost of transportation by highway.

If the Congress will give authority to the War Department to loan or rent the military trucks to the States, counties and local communities for this work, it will confer a great benefit on the public and provide immediate employment for thousands of returning soldiers, who have become accustomed to out-of-door work and life and are likely to retain a preference for it.

Without doubt, the war has had an important effect in improving the quality, as well as stimulating the production, of motor trucks. Truck engineers have learned many useful facts about construction from the exacting service demanded of trucks in war work, and have and will continue to incorporate this knowledge in their new designs. The reputation of leading American trucks has been enhanced tremendously, both at home and abroad, by their excellent performance, and the lesson will not be lost on the newer and smaller manufacturers.

What motor trucks accomplished in the war is a big story by itself and has never been told. At a recent dinner in London, Earl Curzon, of the British War Cabinet, told delegates to the inter-allied petroleum conference that if it had not been for the great fleets of motor trucks the war could not have been won. Whatever of doubt American business men had regarding the capabilities of the American motor truck has been dispelled by their success in this war.

Future growth of the motor truck industry must, of necessity, be predicated upon relevant facts. Today there are paproximately half a million in use in the United States. As compared with these. there are 25,000,000 horses and probably 10,000,000 farm and business wagons. There are more than 6,000,000 farms. Figures are not at hand, if they have ever been compiled, showing the number of manufacturing and mercantile establishments; express, transfer, moving and hauling concerns; mining, oil and lumber companies, etc., that depend on haulage and delivery by highway. They undoubtedly run into hundreds of thousands and nearly all either own motor trucks or are prospective purchasers. Doubtless several million trucks and delivery wagons will be required to meet the transportation needs of the country within the next 10 years.

Whether the railroads are returned to private ownership or are purchased by the Government, they should acquire many thousands of trucks and undertake the collection and delivery of freight, just as the express companies conduct their business. This is a plain matter of national economy and efficiency and will be an important factor in maintaining the necessary volume of business to keep the railroads working at full capacity.

It must be evident, therefore, that the era of motor trucking is still only at its beginning and is certain to see great developments.

American vs. British Patent Protection

(*Continued from page 523*)

able as that of the United States of America.

'Germany has recognized the importance of Invention and has spent a very large sum upon a new Patent Office of palatial proportions.

'There is great credit due to our own country for having been the first to introduce possible remuneration to Inventors by means of Patents. Even if the mercenary stimulus only be regarded, it can safely be said that the world at large has derived much benefit from the work of the Patentee. Many of our great intellectual men of modern times have conferred benefits of the highest order upon the world, whilst they themselves have profited by their inventions.

'In the writer's opinion the rapid progress made in America has been largely due to the wise encouragement of Patents. A cheap patent does not mean a nasty one at all. Low fees stimulate Patent activity, and should be encouraged here much more than in the past. It is a crying shame that in a great empire like ours we do not have one Empire Patent to cover the whole of our Dominions. If America can do this for her 48 separate states and her 80 millions of white population, why should we lag behind?

'At the present time, within the Empire and within the region where the Union Jack floats, to get full protection requires no less than 40 separate Patents, the total cost of which, for a much smaller term of years—only 14 in Great Britain and Ireland—is about £1,340. This total charge, what with special government fees, agent's expenses, patentee's expenses, would probably increase the cost of one Patent to something like double this amount. In other words, to sum up we have a total charge for a Patent within the great American Republic of the ridiculously small sum of £7, covering, as already stated, an area of more than three million square miles and a population of not far short of 100 million people. Against this, to cover our Empire we have the very heavy figure of probably over £2,000—that is, for one Patent—including government fees, also general expenses and charges.

'Is there any wonder, therefore, that with American Patents obtainable for about £7, and for 20 per cent longer time as compared with the £1,340, or not far short of £2,000 to cover all the expenses, paid by a member of this Empire, America goes ahead and develops her material welfare and industry in the way she has done? Without doubt, the mainspring of this enormous development of our American cousins has been their government's wise encouragement of this system of cheap Patents. The writer is speaking of what he knows personally, or he would not lay such emphasis upon this inportant subject. Take for example, the great General Electric Company with its enormous payroll of between 50,000 and 60,000 people at its various works. This corporation has largely developed its present proud and strong position by the wise employment and encouragement of Patents and the Annual Balance Sheet generally refers to the amount spent in Patent protection. This is a very large sum, and yet it is money well expended. In time it brings literally a return of hundreds—in fact, probably thousands—per cent for the expenditure and capital so invested. Only this one instance is mentioned, but it is within the writer's personal knowledge that nearly all successful corporations in America have been largely founded upon important Patents, which enable such corporations, at any rate for the time being, to be in a position of great advantage. By its wise policy America, without doubt, indirectly benefits in a thousand ways. Invention is stimulated and the smaller members of its great federation are encouraged to try and progress in the various arts concerned.

'Surely it ought not to be impossible for our Empire to have facilities equal to those of the United States with regard to Patents. If we are too short-sighted, then let us accept calmly the fact that we shall not progress as our American cousins

(*Continued on page 539*)

From War to Peace and the Demands of Commerce

BUSINESS OFFICE

MILLS

TRANSPORTATION

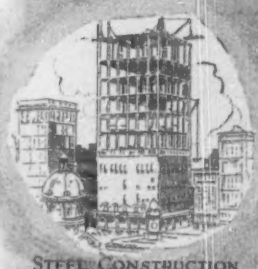
WAR demanded of the UNDERWOOD factory — the largest in the world — over 100,000 typewriters for the use of the United States and its Allies. That we were able to supply this demand is a bright page in our history of success.

PEACE now recalls us to the needs of the public to which we owe our thanks, not only for its continued endorsement of our product, but for the patriotic patience it has shown during the period when all UNDERWOODS were devoted to the necessities of war.

Underwood Typewriters are again available to the commercial world

Underwood Typewriter Company inc.

BANKING



STEEL CONSTRUCTION

SCHOOLS

INDEX

Note.—Illustrated articles are marked with an asterisk (*). Look for the general subject rather than the supposed specific titles of articles. Thus: "Aeronautics," "Automobiles," "Meteorology," "Panama Canal," etc., will give related articles much more quickly than by reference to the title.

A

ADHESIVES in Germany 225
ADSORPTION 251
ADVERTISING, VISION IN 456
AERONAUTICS. See also NATIONAL DEFENSE and WAR, THE EUROPEAN.
ACCIDENTS.
Airplane facts and fallacies .. 151, 211
Electrically heated soles *519
Extraordinary accident 309
Nose spin, question of 49
Nose spin problem 67
Parachutes for airplanes 151
BALLOONS.
Dirigibles, our rapidly expanding fleet of *395
Gas investigations 85
Observation balloon, Italian 453
Our aerial sausages *408
CONSTRUCTION.
Doping, effects of 185
18,000,000-horse-power cruiser .. 453
Leoning monoplane test 185
Oddities in recent design *223
Propeller theories vs. air screw .. *14
Radial engine saves space *462
Spruce for our airplanes 269
Spruce, getting out *438
Streamline efficiency 211
Woods, airplane, defects in *212
Woods for making airplanes *248
Workman's error 247
FLIGHTS, ETC.
Five-and-a-half mile climb *353
Transatlantic flight 4, *101
GENERAL.
Aerial mail, Vienna-Lemburg 63
Aeronautical abstracts 331
Aircraft situation 492
Earth roads and air roads 354
Fog problem 26
Height sounds can be heard 63
Holland-England postal planes .. 185
Lectures on aeronautics 331
London-Paris mail 147
Planes, using the 432
Wireless-plane 151, 391
Royal flight 309
Some aviation economics 313
Surveying, aerial 207
Tools of German airmen *297
Winged police, New York's *215
Wireless and air mail 247
MILITARY.
Aerial activity of late 147
Aerial gunners in making *395
Aerial photography, value of 351
Aircraft mark, new German 247
Airmen, surprise-proof *11
Airplane, new British 351
Airplanes and wireless phones .. *523
Airplanes too large to push *379
Airplane, war feats of 453
Air raid signals 387
Air service openings 407
Ambulance, winged, of U. S. Army *461
American aircraft production 407
Balloon Corps, our expanding 379
Biplane, armored German 407
Bombers, new British 247
Bombing in mid air 351
Bombing planes and targets *86
Bombing planes, our 147
Bristol production stopped 147
British De Haviland four 309
British Independent Air Force .. 309
Browning gun for airplanes 100
Enemy aircraft, recent *274
Enemy cities and allied bombers .. 247
Enmeshing night raiders 147
Fastest aircraft, our *495
Five-motor German plane 147
Flare for night bombing 185
Flying fields, enlargement of 269
Flying tank of Germans *461
Four-engined Gotha 147
From the enemy's own mouth .. 453
Germany crushed in the air? 102
German fighter, new 519
Germany, how, stands in the air .. 351
Germany's production *13
Goggle glass substitute 453
Greatest air raid 407
Handley-Page, our first *53
Hospitals, flying, France 407
How Lieut. Fonck fights 63
Hughes aircraft report 386
Inspectors hold up work 169
Italian propaganda raid 185
Kite balloon, role of *25
Lewis gun for aircraft *13
Mudscraper for airplanes 351
Navigating instruments 141
Navy's winged destroyers *480
Night photographs from airplane .. 309
Oil, Liberty aero engine 200
Our battleplanes abroad 63
Parachute, airman's life and *149
Parachute jump from airplane 309, 375
Parachutes of German airmen 407
Photographic eye of airman *61
Shot gun for airplanes 107
Spad on skids 185
Stability and British machines 247
Storage batteries for aircraft 63
Target aeroplane *511
Testimony from enemy 309
Training our bombers *336
Tricks and acrobatics of fighter *183, *188
"Wasters"—and fair play *192
Wireless-controlled airplane 123
Wireless phones for aeros *523
MOTORS.
Engine power and weight 437
Evolution of aircraft engine 270
Fitting engine for any altitude .. *109
Gnome, working model of *53
Hispano-Suiza engine *7
Langley-Manly engine, that 477
Liberty motor *455
Liberty motor in action 351
Radial engine saves space *462

AGRICULTURE.
Ant, Argentine 63
Asset from liability 67
Barberry, banishing the 351
Battlefields, cultivating 273
"Black alkali," Colorado 103
Bridge built to save crop 407
By-products on the farm 482
Castor bean 107
Chickens by parcel post 511
Crop slackerism 193
Cultivator, motor *276
Desert feed for drought seasons *357
Entomological Service 493
Farm accounting problem 436
Farms for returned soldiers *372
Farm, the circular *105
Fertilizer, ammonia as 233
Fertilizer, new, from Italy 337
Fertilizer, "tetraphosphate" 453
Fertilizing by electricity 167
Fifty billion German allies *47
Fighting insects with insects 167
Fly destruction by manure *36
Four-wheeled tractor steering .. *358
Fumigating houses, large 351
Garden watered by telephone .. *105
Gas engine for grain binder *36
Gas engine, mounting the *36
Geography of world's agriculture .. 207
Hail-rods, France, failure of 351
Harrow, spring-tooth, wheeled .. *276
Hay-loader, tractor-operated .. *482
Hay loading by wind power 36
Irrigated farm: cutting power bills *471
Light and power for farmer *11
Machinery, science in farm 31
Mechanical equipment of the farm *36, *92, *276, *358, *482
Potatoes, how Swiss grow 201
Potato growing: new idea 435
Potato, the original 85
Rabbit pest, New Zealand 66
Shocker machine *276
Soil blasting, benefits of 253
Soils, testing 445
Stagger grass 331
Stock feed from fish offal 64
Thresher and header combined .. 482
Threshing, for better 227
Threshing rig, small 482
Traction operation data 358
Tractor demonstration *358
Tractor of good design *482
Tractors *54, *92, 225, *276, *290, *318, *358, *482
War gardens, community's 189
Wheat, getting most from grain of 492
Wood cellulose as cattle feed 253
World demand for our tractors .. 358
ALCOHOL from sea-weed 371
Solidified *523
ALPHABET, UNIVERSAL 497
AMERICANIZATION 89
AMERICAN ASSOC. A. A *517
AMMONIA—SPECIFIC HEAT 247
ANCHOR CHAIN, NEW 121
ANIMALS.
Grizzlies, record shot of *501
Rogues, freeing range of *501
Sheep, rooks kill 211
Why cow crossed road 127
Why is a dog? 107
ANTIMONY in Transvaal 475
ARCHAEOLOGY.
Flint Ridge district 493
School at Jerusalem 357, 407
ARCTIC. See EXPLORATION.
ARGON FROM THE AIR 168
ARMY. See NATIONAL DEFENSE, WARFARE, and WAR, THE EUROPEAN.
ASTRONOMY.
COMETS.
Borrelly's comet 387
GENERAL.
American astronomers' help in war 27
Calendar, proposed new 63
Heavens month by month .. *12, *70, *170, *254, *338, *440
Herschel, Mss. of 473
Opportunity for amateurs 27
Secchi centenary 473
Shadows in a partial eclipse *31
METEORS.
Brilliant daytime meteor 27
Carina meteor catalog 123
OBSERVATORIES.
Research funds 309
Royal Observatory, Belgium 309
Solar constant station 473
Victoria observatory 225
PLANETS.
Bode's law 67
Lost asteroid Aethra 225
Mars, markings on 387
Mars, novel map of 473
Martian "canals" 375
STARS.
Andromeda nebula 387
Astrographic catalogue 225
Barnard's runaway star 309
Catalog, Henry Draper 387
Determining colors 473
Eunomia 27
Globular clusters 27
Infra-red spectrum photography .. 147
Nebulae, catalog of 70
Nova Aquilae 123
Nova Aquilae No. 3 387
Nova Aquilae: radial velocity 473
Nova Monocerotis 123
Photographic observation 123
Runaway star 170
SUN.
Airplane observation of eclipse .. 309
Eclipse instruments returned 387
Eclipse observation novelties 473
Eclipse observations 123
Fortunate rift in clouds 309
Solar prominences 225
Weather records for eclipse 309
ATHLETICS, NEW EVENT IN 83
ATMOSPHERIC POLLUTION 163
AUTOMOBILES.
ACCESSORIES AND SUNDRIES.
Batteries changed in five minutes .. 123
Fan, variable-pitch *216
Grease vs. oil 225
Jack that always takes hold *112
Oil can that is different *340
Skid, mud hole *523
Springing, departure in 289
Windshield clearer *72
FUELS.
Acetylene gas 103
Alcohol as auto fuel 4
British $5,000 prize 187
Economizing fuel 289
Gas as a fuel 433
Gas, compressed 289
Gas containers 63
Gasoline, limiting 63
Gasoline, saving 225
Heavier fuels 371
Hydrogen gas for fuel 289
Low grade fuels, burning 63
What shall we burn in our cars? .. 313
GENERAL.
After-the-war cars 289
Exhaust gas poisoning 433
French automobile merger 123
Guide signs 123
Man who takes a chance 433
Motor car a non-essential? 188
National automobile laws 123
Pedestrians, rights of 433
Should car fit the man? 123
Steam cars in Philippines 313
Steam power for war zone 289
Sundays, motorless 224
Taxes on automobiles 123
Through main roads 123
Two-story shipping *194
MOTORS.
Air cleaners 371
Air leaks 433
Cylinders, decarbonizing 371 289
Engine efficiency 433
Kerosene engine, oil-cooled 396
Stalling, to keep from *332
Two-cycle super-induction *171
PLEASURE CARS.
26,000 miles without moving *7
TIRES.
Conserving tires 63
How to run with punctured inner tube 289
TRACTORS.
Electric crane tractor *318
Farm tractors *54, *92, *105, 225, *276, *290, *318, *358, *482
French farm tractor *54
Out-of-the-way jobs for tractor .. *290
Tank, French lightweight *297
Tank, secret of "baby" *431
Tanks, tactics and *148
Tanks, will, win the war? 268
Tractor controlled with reins *132
Tractor for cable plowing *318
Tractor power plant improvements *396
TRUCKS.
Army truck trains *132
Building a subway *132
Combination tractor-truck *318
Keeping score of motor truck *134
Laundry like sectional bookcase, *253, 457
Mails, motorizing the *518
Mosquitoes, truck to fight *234
Motor-driven commercial vehicle, *54, 132, *234, *318, *396
Motorized railways *129
Motor trucks economics *514
Motor trucks in the war *125
Oiling, chassis, improved *396
Oiling system, simple *234
Post-war status *520
Postal motor trucks 127
Road transport of future 225
Roller truck, home-made *216
Small auto for coal delivery *112
Trailers increase capacity *134
Trailer, where, made good *234
Transportation, motor 63
Truck vs. bridge *318
Truck Triangle *516
Via motor truck *124
Truck development 516
When freight cars fail *54
USES OF.
Crane hoist, motor truck *396
Rock spreader for roads *396
AVIATION. See AERONAUTICS.

B

BALLOONS. See AERONAUTICS.
BICYCLES: no more punctures 227
BIOGRAPHY, including OBITUARIES.
Gaudry, Jules 27
Meyer, Frank N 387
Wood, General 85
BIOLOGY.
Bastian's experiments again 147
BIRDS.
Battle front, birds at the 461
Hospital for birds 493
Pigeon express *271
Pigeon, passenger 433
Waterfowl, lead poisoning in 185
BIRTH RATE, war and the 207
BLIND SOLDIERS, books for .. 224, *226
BOATS. See MERCHANT MARINE, MOTORBOATS and WARSHIPS.
BOILERS: increasing evaporation 371
BOTTLE STOPPER, NEW 275
BRIDGES.
Emergency bridge saves crop 407
Pontoon equipment, sectional *495
"Pont Wilson," Lyons 269
Proposed North River bridge 493
Quebec bridge, testing *187
BROKEN IDOL 406
BUILDING CONSTRUCTION.
Concrete: practical tests 52
Concrete shell for ugly tanks *128
Construction Division, U. S. A. .. *252
Government's emergency construction contract *213
Government's vast program *186
House, the one-piece *474
Safety nets for workers 225
Who shall do it? 296
BULLETINS electric, from typewriter *442
BURLAP BAGS, LONGER 103

C

CANALS.
Chicago-St. Louis 207
China's Grand Canal 493
Locking the locks *256
Lock, marine railway instead of .. *389
Locks, Canadian lift *389
Lock valves, corrosion of 27
Ship railway at Niagara 67
CANDLE-EXTINGUISHER *484
CANDLESTICKS in France 29
CASTINGS cooled by electricity 298
CEMENT; NATURAL, Greece 403
CHAIR, BEACH, ELECTRIC *277
CHEMISTRY.
Another bond broken 102
Electrochemistry in war 312
German industry, 1917 359
German industry, strength of 339
Industry to order in a hurry 130
Metals, some of rarer *500
New chemical show 3
Outstripping Germany in chemical industry 293
Quantitative spectrum analysis .. 327
Rainbow, the American 394
Scholarships, chemical 247
Service of the chemist, 52, 130, 228, 312, 394, *500.
Statistics, chemical 394
CHICKEN farm, electrical *153
CHLORINE, Government control 371
CIVILIZATION VINDICATED 406
CLOTHING.
Paper clothing 40
What do we wear? 52
COAL. See FUELS, and MINES AND MINING.
COINS, COUNTING, by electricity .. 123
COMPRESSED AIR, DRY *112
CONCRETE.
Compressed concrete 493
Concrete in cold weather *522
House, the one-piece *474
Practical tests 52
Road concrete, denser *462
COOKER, ELECTRICAL 453
COPPER, German and American 276
COPPER in Sweden 339
CORN COBS, COOKING 273
CORRESPONDENCE, 9, 31, 49, 67, 89, 107, 127, 151, *189, 211, 229, 251, 273, 293, 313, *335, 355, 375, 391, 411, 437, 457, 477, 497.
COTTON.
Cotton picker, successful .. *315, 411
Cotton seed, concerning *498
Fires, cotton gin 351
Removal of one bale from pile *94
Silk replaced, gun-powder bags, 228, 269
COULTER, J. M *517
CRANE HOIST, motor-truck *396
CUTLERY INDUSTRY, OUR 272

D

DAMS.
Concrete work, zero weather 147
DAYLIGHT SAVING *522
Spillway gate, steam-heated 351
Timber facing for leaky dam 147
DEHYDRATION IN AMERICA. *291
DIAMONDS, ARTIFICIAL 159
DIAMONDS, BROKEN 513
DIEING MACHINERY, new *442
DISEASE. See MEDICINE AND SURGERY.
DOORS, SOMETHING NEW IN .. *216
DYES AND DYESTUFFS.
Coal-tar color chemistry 371
Markets for our dyes 154
Textile engineers of tomorrow .. *232

E

EARTH. See ASTRONOMY, GEOLOGY, etc.
ECONOMICS OF PEACE 476
ELECTRICITY.
ELECTRIC LIGHT.
Adjustable light for garage 163
Brightening the world 115
Burns out without breaking down .. *94
Compact electric lantern 45
Incandescent lamp efficiency 123
Motion picture arcs 185
Searchlight with ears *379
Voltage stabilizer 289
MISCELLANEOUS.
Automatic hydroelectric plant 263
Ball bearings for motors 5
Battery, new primary 5
Bearings, pitting of 5
Cell, new experimental 163
Commutators: micanite insulation 331
Direct production of electricity .. 151
Edison cell current efficiency 387
Electrolysis: new application 473
Fuse tester, illuminated 331
Generators, electrolytic 45
Ground connections for systems .. 493
Hydrogen and carbon 185
Inductance, calculating 473
Increasing cable capacity 45
Insulator depreciation 5
Insulator, strain 185
Light and power for farmer *11
Long-distance transmission 331
Magnet, improved hand 5
Magnetite electrodes 85
Meter, chemical 85
Motor speeds, slow 45
Photo-electric cell yielding alternating current 289
Pole holes, boring 123
Selling service by the can *332
Storage cell separators 247
Switch, shock-proof *416
Temperature measurement 5
Vibration in electric circuit 247
Weston cells, researches on 331
RAILWAYS.
Economy of electric operation 351
Rails, hardening laid 83
Skip-stop's good results 473
Street car loading efficiency *93
Subway link, new *71
Track switches, grinding *94
Train operation, automatic 107
Trolley, clearing way for *231
Wonderful railway record 103
TELEPHONES.
Automatic exchange, Europe 433
Automatic exchange, largest 425
Highest system in world 289
Telephone tangles *87
Transatlantic transmission *189
Wireless in Japan *298
ENGINEERING.
Night surveying in desert 207
Specialist, new kind of 184
Women engineers, French 269
ENGLISH CIVILIAN, fortunate 128
ENGRAVER, ELECTRICAL 45
EXPLORATION.
ARCTIC.
Alaska, remarkable journey in 433
Magnetic equipment, Amundsen .. 103
Rasmussen in Greenland 45
GENERAL.
Africa 147
American Pacific Ocean *441
EXPLOSIONS, GRAIN-DUST 147
EXPLOSIVES.
Detonators, new 284
Gunpowder, cotton bags for 228
Seaweed for war *231
Toluol from new source 215
Toluol, sources of 85
EYES in the finger tips 167

F

FACTORY, GOOD HOUSEKEEPING IN *208
FAT, new source of vegetable *357
FIRES AND FIRE PREVENTION.
Again, the fire hazard 309
Dust and fire 44
Dust danger 309
Electrical fires, New York 85
Fires from dust in clothing 225
FISH AND FISHERIES.
Fish-rescue work, Mississippi 351
Improving fish by smoking 77
Laboratory, new, Fairport 185
Mussel farm, Government's *316
Whale meat approved by public .. *388
FLOORS, concrete, for foundries 493
FLOORS, polishing, electrically *112
FOOD.
Bran, who shall eat the 229, 293
Bread, Poilu's daily *415
Bread, substitute *415
Cafeteria, cousin of the *193
Camouflaged food *152
Can and sealer, sanitary *72
Corn, getting real food out of *298
Dehydration 52
Dehydration industry in America .. *291
Drying process, new German 403
Eggs should not be washed 403
Facts vs. fallacies 268
"Flourless bread" 379
Food administration and nation's response *309
Foreign food and drug laws 107
Fruit store, chloride of calcium in .. 215
Milk, cows 10,000 miles away 295
Peace, economics of 476
Safety limit, canned goods 67
Vegetable drying, Germany 375
Whale-canning, Canada 447
Whale meat approved *388
Wheat bran 106
Wheat substitutes 331
FOREIGN TRADE. See INDUSTRY AND TRADE.
FORESTS. See TREES AND FORESTRY.
FOR THOSE WHO SEE WITH THEIR FINGERS *226
FUELS. See also AUTOMOBILES.
Coal, ash reveals the 426
Coal saving in Pittsburgh 163
Coal storage, submerged 27
Coal, wasted resources of 371
Coke and the coal shortage 433
Coke making processes 163
Cottonseed oil cakes 202
Engine fuels, new 194
Fruit pommace as fuel 51
Fuel facts 309
Gasoline, Red Cross saves 384
Government and coal distribution .. *6
Mountains of oil *29
Oil and gas inspectors 89
Saving, double-barrelled 27
Stoker, efficient underfeed *256
Weathering of coal *316
Wood shavings for power plant .. 103
FUSES, CLOCKWORK 85

G

"GARABED" 26, 162
GARBAGE UTILIZATION 200
GARLIC, respectable use for 202
GARMENTS, precisely fitted *172
GASES, PURIFYING 453
GAS-MASK FACTORY, in the *275
GAS METER, electric *416
GAS TANK, moving a *171
GAS, traces of war 501
GEOGRAPHY.
African maps, place-names on 453
Atlas of the world, Italian 289
Himalayan peaks, names of 407
Lake Nyasa rising 433
Maps, old Scotch 207
Mount Everest joke 31
GEOLOGY.
EARTH.
"Air blasts" in gold field 45
Handbook, Northern France 163
Intermittent siphon *131
Mammoth and Great Onyx caves .. *155
Temple of the Gods, Utah *267
EARTHQUAKES.
Earthquake effects in mine 185
Mexican seismology 338
VOLCANOES.
Glaciers, volcanoes and 335
Katmai expedition 63
Persistent vents 5
GERMANY.
Copper scarcity 5
Minerals, use of low grade 33
GLAZING WITHOUT METAL .. 172, 202
GRAND CENTRAL DEPOT, new approach *378
GRINDER, portable electric radial .. *340
GRINDING MACHINES and blotters 103
GROCERY, SELF-SERVICE *193
GUNS. See ORDNANCE AND ARMOR, and RIFLE.

H

HARBORS, DOCKS, ETC.
New York, improving port of *401
HARNESS and saddlery sales 154
HOIST, small electric 185
HONEY AND HONEY PLANTS .. 351
HOUSEHOLD, MACHINERY IN .. 216

I

ICE formation over stream *501
Kerosene lamp, efficient .. *276, 335
Wartime lighting, Denmark 263
INDIAN, VANISHING 496
INDIVIDUAL RESPONSIBILITY. 44
INDUSTRY AND TRADE.
Advertising, cinematograph 211
Advertising, vision in 456

(Continued on page 540)

American vs. British Patent Protection

(Continued from page 536)

have done, unless we offer the same advantages. But we do not put this down to want of knowledge or to our people being inferior, whether as regards master or man. As our first president, Sir Dugald Clerk, F.R.S., has shown, inventive genius and the study of research in this country are not behind, but rather in front of other countries; but we do not develop these talents in the proper and businesslike way we should do. In some cases the owner of a Patent is very much like the man who throws the proverbial stone into a pond, the ripples from which extend and circulate in a manner which causes no little astonishment. In the same way it is difficult to say when and where the benefits obtained from a successful Patent, whether to the Patentee or to the consumer, begin and end."

NEW BOOKS, ETC.

ANALYZING CHARACTER. By Katherine M. H. Blackford, M.D. and Arthur Newcomb. New York: Henry Alden, Inc., 1918. 8vo.; 500 pp.; illustrated.

"Analyzing Character" is a volume that everyone will find instructive and entertaining, but it is especially interesting to the misfit; for misfits are the result of a lack of self-knowledge, and man must learn to analyze his own character before he may benefit by analyzing the characters of others. So the authors first discuss the causes of vocational misfits taking up the case of the physically frail, the dreamer, and other types. Other sections deal with the selection of employees, the analysis of character necessary to successful persuasion, and the scientific basis, applications and uses of the art. Large plates of prominent figures in the scientific, political and literary worlds are used to point out the facial characteristics of varying types. Without directly citing technical principles, the work indirectly familiarizes the reader with those principles, in a manner delightfully conversational and natural.

THE AUTOMOBILE STORAGE BATTERY. Its Care and Repair. Chicago: American Bureau of Engineering, Inc., 1918. 8vo.; 284 pp.; illustrated.

The starting and lighting battery is called on to perform so different a service from the battery in stationary work that it has a design, construction and operation distinctively its own. This meritorious handbook, confining itself to the lead-acid type, covers in its first section the theory, design, operating conditions and care of the automobile battery, while the second section deals with repairing and rebuilding, and is of especial interest to the battery repairman. The work represents the accumulated experience of leading firms and individuals, and is an exceptionally valuable contribution.

THE GEOLOGY OF VANCOUVER AND VICINITY. By Edward Moore Jackson Burwash. Chicago: The University of Chicago Press. New York: The Baker and Taylor Company. 8vo.; 106 pp.; illustrated, with 3 folding maps. Price, $1.50 net.

Those in any way interested in the geology of the Pacific coast will find in this monograph a careful study of the locality with which it deals; the region is shown by large maps in color, upon which are indicated the various deposits and formations. The discussion includes field work, the Paleozoic, the post-Paleozoic prophyrites, the Upper Jurassic, Eocene, and the Garibaldi volcanic formation, with a geographic introduction and description.

HATE WITH A WILL TO VICTORY. By J. Hartley Manners. New York: Mitchell Kennerley, 1918. 12 mo.; 59 pp. Price, 25 cents.

The burden of Mr. Manners' discourse is that we beware of a German peace. He shows that in the complete humiliation of the Hun lies the only hope of abiding peace; he expiodes the fallacy that the German people are good-hearted, easy souls with whom we have no quarrel; and he shows by Germany's own statistics that they are the most lawless of all civilized races with, in a single year, 797,112 convictions under the national laws, many of these for the most vicious and degenerate offences. Both author and publisher forego any profit from the sale of the work.

HOME-MADE ELECTRICAL APPARATUS. By A. M. Powell. New York: Cole and Morgan. 8vo.; 202 pp.; illustrated. Price, $1.

LESSONS IN WIRELESS TELEGRAPHY. By A. P. Morgan. New York: Cole and Morgan. 12mo.; illustrated.

The amateur experimenter who successfully builds his own apparatus necessarily has a clear idea of its anatomy and functioning; and then the thrill of being able to announce exultantly, "It works!" He learns the importance of attention to petty detail, and gains a practical outlook that makes success in life easier. "Home-made Electrical Apparatus" is a good friend to the young scientist, teaching him to make primary and storage batteries, transformers, telegraphers and telephones, and many other outfits and devices. "Lessons in Wireless Telegraphy" is a systematic elementary course in the principles of the art and the electrical laws upon which it depends. Operators who wish to understand the rudimentary theory of the instruments will find this manual a plainly-worded introduction to the subject.

THE SHIPBUILDERS' BLUE BOOK. By Walter Kay Crawford. Edited by E. R. Glass. New York: Ocean Publishing Company, 1918. 16mo.; 79 pp.; illustrated. Price, $1.50.

A practical man of thirty years experience in the shipyards of Europe and America here condenses that experience for the benefit of the apprentice and ship fitter, thoroughly covering rivets and riveting, buttlaps, buttstraps, brackets, frames, plating, etc. There is also a glossary of shipbuilding terms, numerous tables, rules and standards, and much other information that the ship fitter will recognize as filling an everyday need.

HAMMOND'S STRATEGICAL WAR MAP OF THE WESTERN FRONT. New York: C. S. Hammond and Company, Inc., 1918. 78 x 56 inches. Paper, folded in cover. Price, $4.

HAMMOND'S FIVE MILE MAPS OF THE WESTERN FRONT. In three sections. New York: C. S. Hammond and Company, 1918. Paper, folded in cover. Price, each section, 50 cents.

The Strategical War Map, on a scale of five miles to the inch, is a new, accurate, and most satisfactory production. Its size permits the indication of practically every village and hamlet, with their names in such large, clear lettering that the map is unequalled for display purposes. Upon it may be located also all fortresses, fortified towns, naval arsenals, railways, wireless stations and aircraft depots. The region covered extends north to Antwerp, east to Frankfort, south to the Swiss border, and west to Dieppe. The various battle lines are boldly traced—the farthest German advance of 1914, and again of 1918, the Hindenberg line, and the present fighting front. The publishers are to be congratulated upon their achievement. If convenience in handling is an object, then the three sectional maps will make a strong appeal. These are on the same five-mile scale, with heights of land in separate layer tints, contours and scales in meters and feet, and the same attention to minutiæ and clear-cut printing that makes the larger map so distinctive.

SUBMARINE VESSELS. Including Mines Torpedoes, Guns, Steering, Propelling, and Navigating Apparatus. By W. E. Dommett. New York and London Isaac Pitman and Sons. 12mo.; 116 pp.; 21 illustrations, 16 full-page plates. Price, $1.

These collected notes of a well-known British engineer appeal both to the general reader and the technical man; they are understandable by the one, yet contain much that may be new to the other. British submarines are ably presented, and a skilful naval photographer has supplied plates illustrative of the different types. There are chapters on submarine tactics, defense tactics, and exploits of the present war, and a description of auxiliary vessels. Altogether, the work strikes a fair balance between the technica and the popular, and provides access to really worth-while knowledge in entertaining form.

THE BLUE BOOK OF FACTS OF MARINE ENGINEERING. New York: Ocean Publishing Company, 1918. 16mo.; 116 pp.; illustrated. Price, $2.50.

This is a third edition, revised to date, of a handbook that has been well received. It is addressed directly to the engineer who is going up for any grade of marine license, and the questions, answers and problems it contains include the knowledge necessary to pass as first, second, or third assistant, or as chief, so arranged that only that need be studied which bears upon the examination he is to take. This arrangement is an improvement over former editions, and candidates will find the catechisms to the point, and the problems such as they may expect to meet in the test papers.

THE EATON AND BURNETT PRACTICAL BOOKKEEPING. Corporation, Voucher, and Cost Accountancy. By A. H. Eaton Attorney-at-Law. Baltimore, Md.: Eaton and Burnett Business College, Inc. 8vo.; 261 pp.

The various branches of bookkeeping and accounting are here dealt with, and the application of business methods is outlined. The aim has been to provide a textbook for business colleges, public and high schools, and home study, and at the same time a work of reference for the counting house.

SLEEP, OR LIFE AND THE LAWS OF MOTION. By J. R. Kendall. 16mo.; 91 pp.; illustrated.

The author takes the vibration to be the work formula of Nature, and develops a conception of life that is at one with the laws of motion. Every manifestation of energy being bipolar, he is guided to the conclusion that conscious and unconscious are polar coordinates; the significance of sleep is thus emphasized, and life is defined as a mode of motion in an organic medium.

EVERYDAY EFFICIENCY. By Forbes Lindsay. New York: Thomas Y. Crowell Company, 1918. 12mo.; 300 pp. Price, $1.25 net.

In this work, a graded course of home study is offered, to the end that any man or woman may increase his or her mental, physical and functional efficiency. The first part of the work is directed toward abolishing timidity and worry, and to developing the will, observation and memory; the second part treats of hygiene, food, exercise and rest; while the third part deals with time consumption, records and plans, with scheduling, despatching and standardizing. It is an ably written and distinctly helpful course.

The Speed Champion of the Navy is Protected by "85% Magnesia"

The tremendously rapid growth of Uncle Sam's Destroyer fleet has been one of the most powerful factors in the elimination of the "U-boat" as a menace to our convoys.

Nobody outside of the Government knows how rapidly these "sea wasps" are being launched. Nobody knows how many of them there are now breasting the stormy Atlantic, safely convoying America's mighty army to its triumph over the Hun.

A Destroyer's value is measured by her speed. It must be the speed of quick dashes for striking before the "U-boat" submerges.

That high speed depends upon the unfailing volume of hot, dry Steam she can transmit from her boilers to her powerful engines. A Destroyer "fights on her steam," just as an army "fights on its stomach."

But that steam would quickly condense to its original water were not the boilers that produce it, and the pipes that carry it, *thickly armored with the most effective heat-insulation*. If that insulating armor were weak the Destroyer couldn't do her job.

What then is that master heat insulation that Uncle Sam employs to enable his Destroyers to get their highest steam efficiency?

It is "85% Magnesia." That is what the U. S. Navy has specified since 1887—not only for its Destroyers, but for its Battleships, Cruisers and Transports.

Why? Because "85% Magnesia" is the most effective and practical heat insulation known to engineering science. Because "85% Magnesia" keeps the maximum of heat in boilers and pipes, whereas an inferior covering would allow much of it to escape and thus reduce the steaming power.

What "85% Magnesia" does for our Navy, it also does for our powerful Locomotives, all of which are "lagged" with it under their outer iron jackets.

It does the same unequalled service for our Central Stations, for our greatest industrial Plants and Coal-mines. Even where steam has to be carried for miles in above-ground pipes, exposed to zero weather, "85% Magnesia" coverings keep it hot and dry.

It saves the coal in our largest Sky-scrapers, Department Stores, Hotels, Terminals, in our best constructed Public Buildings.

It saves the coal, in corresponding ratio, in unnumbered Private Residences.

Wherever "85% Magnesia" is used for heat-insulation it *saves from 80 per cent. to 95 per cent. of the heat that would be wasted from bare pipes and boilers.*

In this COAL-SAVING crisis, the service of "85% Magnesia" is perfectly obvious. It reduces the consumption of the precious coal to the minimum by simply saving the heat that would otherwise escape.

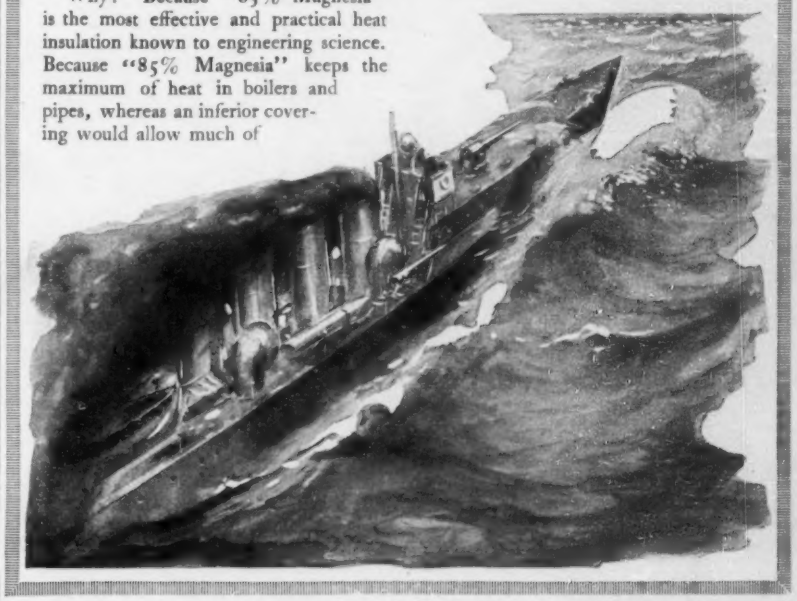
Write to us for the "Table of Monthly Coal-Savings in Dollars and Cents by the Use of '85% Magnesia' Pipe-coverings."

If you are an Engineer or Architect, send also for the Specification for the proper application of "85% Magnesia," compiled and endorsed by the Mellon Institute of Industrial Research, and issued by the

MAGNESIA ASSOCIATION *of* AMERICA

721 Bulletin Bldg. Philadelphia, Pa.

EXECUTIVE COMMITTEE, Wm. A. Macan, Chairman
George D. Crabbe — The Philip Carey Co. — Cincinnati, Ohio
Alvin M. Ehret — Ehret Magnesia Mfg. Co. — Valley Forge, Pa.
J. R. Swift — The Franklin Mfg. Co. — Franklin, Pa.
R. V. Mattison, Jr. — Keasbey & Mattison Co. — Ambler, Pa.



Start Your Boy on the Road to True Manhood!

This is the formative period of your boy's life. What he will amount to in after years depends largely on what he is reading now. You want him to be wide-awake and progressive—to be forward-looking—to develop ideas and initiative and to learn to make his own way in the world.

Two Months Trial Subscription Only 15 Cents!
(Exactly half price)

You can make him no better gift. THE BOYS' MAGAZINE will give him entertainment, instruction and inspiration to accomplish things. It is filled every month with the kind of matter that delights boys' hearts and makes good citizens. Articles on Science, Electricity, Hunting, Fishing and Camping Stories, Travels, Athletics, Games, Contests, Photography, Boys' Clubs, Stamp and Coin Collecting, Poultry and Pets, Anecdotes and Jokes.

This special offer is open to new subscribers only. Make this small investment now for your boy's happiness. Remit in stamps if more convenient.

On sale at all newsstands, 15c a copy. Address

THE SCOTT F. REDFIELD CO.,
2530 Main Street Smethport, Pa.

Auto Signal

Used by over 40 manufacturers as standard or optional equipment. Easily attached. Sold everywhere.

BUELL EXPLOSION WHISTLE

Simplest and most powerful, never needs adjustment GUARANTEED 10 years. Single Tone $4.25 Chime $6.00.

Send for circulars.

Buell Manufacturing Co.
2988-90 Cottage Grove Ave. Chicago

Soon you will have to compete in low cost *haulage*, as well as in low cost production—or merchandising.

No more than you can compete in business without cost records, can you compete in truck economy without *mileage* records—and the

Veeder
HUB ODOMETER

Records distance traveled by your truck, as against its *"traveling expenses."* A powerfully put up mechanism that always *adds* mileage, whether truck runs forward or backward. Price, $20. Ford model, $15. *Write for literature.*

THE VEEDER MFG. CO.
18 Sargeant St. Hartford, Conn.

INDEX

(Continued from page 538)

Army, our, in forest and factory .308
Australians, friendly .214
Bolivia, rocky road to .234
Border fever the .502
Brickmaking machinery for Europe .*110
Brightening the world .115
Business precision .406
Business, requisites in .27
By-products, Pribilof Islands .473
Chilean trade, high tide of .*456
China's second childhood .*339
Commercial highway, Europe .328
Competition for labor .45
Cooperation of a museum .410
Cuba, prosperity in .*66
Disillusionment .162
During and after the war .472
Exigencies of war .269
Export licenses for samples .414
Export trade, what, means to American industry .*287
Factory, good housekeeping in .*208
Federal and State cooperation for post-bellum reconstruction .288
Federal employment bureau .122
Foreign trade, 1918 .163
Foreign trade? why .335
Freedom of the seas .472
French factories, restoring .281
German worker, slavery of .473
Germany after the war .335
"Good will," keeping alive .31
Government's emergency construction contract .*213
Grain elevators for Africa .390
Iceland buying our goods .339
Industrial bedfellows, strange .360
Industrial organization, new cycle in .229
Intensive training, British .473
Japan's growing industries .34
Little things count .214
"Made in U. S. A." .433
Management, intensification of .150
Market and the merchant .214
Methods that win .282
Mexico City, American Chamber of Commerce in .214
Mining machinery for Chosen .*414
Nation's work in terms of manpower .371
Necessary document, foreign trade .110
Ocean highways, reconstructing .437
Office stationery, saving of .457
Oriental industries .*502
Peace basis, coming back to .89, 211
Philippines as trade base .456
Place for every man .*494
Preparedness for peace .62
Problems of peace .288
Profits, abnormal, should cease .477
Reconstruction .410, 485, 492
Reconstruction, economics of .452
Right way vs. wrong .159
Russia, economic conquest of .66
Ships and banks will help us .280
Spain, economic program in .433
Strikes and our war .27
Surgical instrument trade .34
Teaching worker to feel war .*190
Thrift vs. economy .103
Trade for the asking (Africa) .414
Trademark, a national .34
Trading capacity, increasing .154
U. S. Employment Service .127
Uruguay wants direct trade .66
Walking, making, safe .27
Walnut for war uses .163
War labor problems .122
War, saving grace of .*454
War Trade Board, work of .30
World markets for American manufacturers .34, *66, *110, 154, 214, 280, *339, *414, *456, *502

INSECTS.
Insects take to aviation .63
Sense of small in insects .67, 189
White ant, defense of .433

INTERVIEWED, art of being .184

INVENTION AND PATENTS.
American vs. British patent protection .523
Appliances for wounded .371
Department of Inventions and Discovery .492
"Garabed" .26, 162
Government use of patented inventions .14
Hoist with own petard .102
Inventions—Allied and German .370
Inventions new and interesting .*72, *94, *112, *156, *172, *194, *216, *256, *277, *298, *340, *360, *416, *442, *462, *484
Inventions, recently patented .*16, *56, *74, *174, *196, *258, *320, *342, *364, 380, *398, *418, *444 *526
Inventors, notes for .462, 484
Patent decisions, latest .447
Patent decisions, recent .360
Patent Office, needs of .497
Patents, enemy-owned .72
Price-fixing contracts .72
St. Patrick in Patent Office .162
Trademark registrations .112
Trademarks in South America .246
War and discovery .391

IRON, anchoring, in cement .276
IRON, ELECTRIC CAST .271
IRON, magnetic separators .309

J

JUGGLER, how, catches fish from air .*349

K

KIT, soldier's or camper's .*156
KNITTING NEEDLE .*14
KULTUR .350, 477

L

LATHE, DOUBLE-BARRELLED .*193
LAUNDRIES, ARMY CAMP .277
LAUNDRY, MOBILE, NOVEL *253, 457
LEATHER, HARDENING .163
LEATHER, substitute, new .275
LITHOPONE IN ITALY .473
LOCOMOTIVES. See RAILROADS.

M

MACHINERY PHOTOGRAPHS .*93
MAGNESIUM, substitute for tin .476
Galton Society .103
MAILS, MOTORIZING .*518
MARINE LIFE, FILMING .*10
MEDICINE AND SURGERY.
Alaska, health conditions .5
Aniline colors for war wounds .35
Army and better medical care .116
Blood transfusion, new method .426
Bullets, finding, with X-ray .*255
Carelessly-guarded gate .350
Color blindness .289, 387
Dropsy, prisoner's .169
Hay fever and walnut pollen .185
Hay fever, facts about .269
Hay fever, hereditary .371
Hog cholera bacillus .5
Hookworm in the army .269
Hospital ship, Sulu Islands .269
Hygiene, National Committee for Mental .206
Influenza commission .433
Influenza, sure cures for .425
Loss of blood, serum method .39
Malaria germ, hibernation of .387
Mechanical surgery, advance in .*35
Nation's health and draft .185
Neuralgia and climate .375
Nomenclature, unifying .85
Noses, deformed, inlays for .189
Odd ways of transporting wounded .*168
Psychology, clinical .45
Public Health Service reserve .432
Red Cross tuberculosis unit .331
Rehabilitation, side lights on .*461
Sanitarians, training school for .269
Shell shock 70 years ago .89
Skin diseases from lubricants .519
Smallpox on Mexican border .407
Soldiers, odd treatments for .*475
Spain, rural hygiene in .407
Spanish influenza .*356, 386
Surgical instrument manufacture .493
Trained secretaries .45
Trench fever traced to vermin .284
Tubercle bacilli in cheese .371
Tuberculosis, cure of .201
Weather and the epidemic .497
With scalpel and drug .355
Yellow fever, to rid world of .269

MEGAPHONES, RECTANGULAR .256

MERCHANT MARINE.
American built schooners for French .*311
British shipping losses .331
Builders give day's labor .5
Camouflage, compulsory .207
Compasses, testing .103
Concrete barges, growth of .103
Concrete shipbuilding, Singapore .269
Concrete ships, durability .85
Concrete ships for Board .5
Cost—steel, wood, concrete .5
Dubbing machine, electrical .103
Electric welding and cargo capacity .331
Electric welding in shipbuilding .247
Emergency repairs to transport .*151
Engine assembly, speeding .371
French cargo boat, largest .234
Italy's contribution .*108
July 4th in our shipyards .*3
Lengthening ships for speed .251
Losses, our, in merchant ships .493
Mail steamers, 35-knot .457
Mast turning lathe .407
Ocean highways, reconstructing .437
Portholes, keep, closed .331
Protected ships .107
Rats, fumigant for .103
Rudder stock, wooden, shaping by machinery .*359
"St. Paul," salvaging the .*314
"Salting" of wooden ships .27
Salvage of deep-sunk ships .*43
Salvage suggestion .107
Shipbuilding center, our largest .269
Shipbuilding in dry dock .27
Shipping situation .269
Ship plates and explosions .67
Ships of stone, 1849-1918 .*165
Ship tonnage, one week .269
Shortage of ships .*90
Standardized ships .206
Teaching worker to feel war .*190
"Tuckahoe" maintains record .45
Two more vessels for Shipping Board .331
"Unsinkable" cargo ships .26
Unsinkable ship, French .*32
Unsinkable ships .9
Wave pressure of ships .493
Women as welders .473
Wooden shipbuilding, Australia .249
Wooden ships an emergency measure .493
Wooden ships, machines for making .*33

METAL DRILLS, test on .309
METALS, fine deposition of .163
METALS, physical properties of .289
METALS salvaged from battle .304
METAL stresses, motion pictures of .*329
METALS, X-RAYS ON .262

METEOROLOGY.
Aurora at low levels? .309
Aurora, spectrum of .27
Climate, improving desert .63
Dustfall, interesting .453
Earthquake weather .289
Fog problem in aviation .26
Low temperature record .45
"Northers" of Canal zone .207
Plants for measuring climate .289
Signal Corps school .63
Station, southernmost .45

METERS, multiplicity of .473
MINERALS useful in war .493

MINES AND MINING.
Blasting, laboratory evidence .85
Bureau of Mines .5
Coal washing apparatus, new .283
Germany and French ores .246
Locomotives, battery .85
Magnetic data for surveyors .407
Minerals Act .401
Ore detection, electrical .185
Petroleum substitutes for lamps .407
Protection against explosion .207
Search for metals, Germany .415

MIRROR SURFACES .89

MOTORBOATS. See also WARSHIPS.
Rudders, new departure in .*249

MOVING PICTURES.
Cine-motor—touring "movies" .*93
Marine life, filming .*10
Metal stresses, pictures of .*329
Motion pictures and patriotism .311
Portrait photography .*28

MUSIC AND MORALE, British .154

N

NATIONAL CHARACTERISTICS .308

NATIONAL DEFENSE. See also AERONAUTICS, NAVAL AFFAIRS, ORDNANCE AND ARMOR, WARFARE, and WARSHIPS.
Billions or brotherhood .477
Building program, Government's vast .*186
Camps, flies and mosquitoes .269
Caps, "overseas" .211
Case of Gen. Wood .49
Colored men in the war .85
Construction Division, U. S. A. .*252
Enemy in our midst .146
Fifteen months war preparation .44
Finding right job in army .202
Finicky inspectors and war work .251
Gas-mask factory .*275
Guns, in the service of the .*392
Individual responsibility .44
Japanese bugaboo .146
Laundries, army camp .277
Men behind the guns .*376
Property, alien .335
Red tape procedures .355
Safeguarding military ideas .184
Sirens, air-raid, New York .*7
Steam laundry goes with army .*359
Wanted, maps and drawings .94

NAVAL AFFAIRS.
Naval strength in 1920 .493
Navy to man merchantships .85
Our Navy abroad .5
Peace and naval policy .432

NICKEL PLATING, rapid process .453
NITROGEN from atmosphere .123
NITROGEN PLANT, largest .269
NOTES AND QUERIES .80, 244

O

OCEAN, AMERICAN PACIFIC .*441
OFFICE STATIONERY, saving of .457
OIL FROM BONES .170
OIL, MOUNTAINS OF .*29
OPTICAL GLASS, improving .85
Inertia of the eye .*255
Lens-definition errors .247

ORDNANCE AND ARMOR. See also WARSHIPS.
ARMOR.
"Queen Elizabeth" .49
GUNS.
Airplane, meeting armored .9
Anti-tank gun .45
Artillery keeps pace with infantry .*352
Biggest gun ever built .*169
Big-gun emplacement, German .*233
Browning gun for airplanes .100
Cannon of British tanks .*187
Erosion, gun .207
German guns, worn-out .206
German losses in guns .*317
Gun camouflage .*460
Guns and shells for 1919 .331
Gun that will shoot into space .433
In the service of the guns .*392
Lewis gun in first place .5
Lewis gun stripped .*13
Machine gun, light French .*233
Machine gun, practical super .*297
Machine guns and small arms .45
Men behind the guns .*376
New gun plants for army .207
Spotting the shots .477
Wear of guns .62
PROJECTILES.
"Dude" shells re-dressed .*35
Grenades for our grenadiers .340
Shell-band, stripping .49
Shell-loading plants .45
Shell of 75-mile gun .67
Vanadium and long range guns .172

ORGAN, bamboo, Shanghai .328

P

PACKING CASES, empty, retrieved .228

PAPER.
Finland and world's supply .411
Paper from dead leaves .142
Paper, how to get .293
Paper yarn, Germany .426
Pine needles, paper from .368

PATENTS. See INVENTION AND PATENTS.

PERMEATOR, TEST BY THE .328

PHONOGRAPHS.
At other end of phonograph .*164

PHOTOGRAPHY. Se also MOVING PICTURES.
Duo-negatives .194
Industrious photographer .*310
Lamp, novel laboratory .*442
Machinery, photographing .*93
Motion-picture portraits .*28
Horizon, variation in dip of .387

PIERS, BRICK, strength of .493
PILES, protecting, from teredo .*128
PINE NEEDLES, use for .440
PIPE, BENDING, COLD .*484
PLACE FOR EVERY MAN .*494
PLANING, putting speed into .*442

PLANTS. See also AGRICULTURE.
Aztec food plant identified .351
Climbing plant, recording movement of .*255
Disease resistance, breeding for .207
Flower that catches insects .*64
Journal, abstracting .63
National forest range plants .207
Roots, biological features .*373
Seed germinates after 25 years .453
Seeds, guide to the .103
Soil oxygen, deficient .289
Unventilated chambers .247

PLATINUM, new substitute .146
PLATINUM, one in quarter million .153
PLATINUM to be declared (France) .328
POSTAL RATE, ZONE .4

POTASH.
Germany's trade, future of .433
Lavas, potash from .262

POTTERY, PREHISTORIC .147
PRINTING INK, manufacture of .240
PROJECTILES. See ORDNANCE AND ARMOR.
PYRITE in Pennsylvania .45

R

RADIUM, CHEAPER .53
RADIUM INVESTIGATIONS .5
RADIUM SUBSTITUTE .501

RAILROADS. See also ELECTRICITY.
Air brakes, portable compressor for testing .*360
Commercial highway, Europe .328
Derailer to protect track workers .*462
Earth roads and air roads .354
Electrification, Sweden .453
Embankment of molten slag .207
Locomotive bell, unique .*277
Locomotive, most powerful .*294
Motorized railways .*129
New approach to Grand Central .*378
Pacific, new route to .269
Perpetual motion, official endorsement of .391
Rails, kinked .158
Subway, New York's .27
Subway work, difficult .*209
Unification of our railroad systems .288, 308

RECONSTRUCTION. See INDUSTRY AND TRADE.
REHABILITATION, side lights on .*461
REVENUE BILL .512
RIFLE, THE.
Anti-tank shoulder rifle .*233
German substitute for Browning, *215, 273, 355, 391
Gunstocks .*270
Rifles for 2,000,000 .45
Self-loading military rifle .272, 437
RIVER lays own revetment .269

ROADS.
Automatic signaling, highway .*277
Blast furnace slag for roads .371
Concrete, producing denser .*462
Mirage, road .*335
Motor can cross, cow can't .*194
Pavements, cracks in .147
Pavements, preventing cracks in .351
Retaining walls, concrete .407
Road building .371
Rock spreader, labor-saving .*396
Street cleaning, motor .351
Tarred streets and tree damage .351

ROAD-TOWN .411

RUBBER.
New regenerated rubber .256
Rubber, Fiji Islands .433
Vulcanizing accelerators .394

S

SAFETY. See also FIRES, MERCHANT MARINE, and MINES AND MINING.
Breaking hard drills .*340
Derailer to protect track workers *462
Scarcity of trained engineers .309

SALT, ocean, and electricity .453
SALTPETER, new deposits .431
SALVAGE SYSTEM, national .437
SALVAGE WORK, notable .433
SAVING GRACE OF WAR .*454
SAW, hack, continuous-stroke .*340
SAW, toothless, in '80's .151, 273, 375, 437
SCALES, STABILIZED .*156

SCIENCE.
American Journal of Science .85
Applied science, Great Britain .331
British War Office technical journal .268
Canal zone investigations .508
Cause and effect, study in .386
Meeting of societies .163
New Zealand journal .45
Publication, systematizing .103
Schools in West Africa .331
Survey of Porto Rico, etc .387
Terminizing, gentle art of .84
Walker Grand Honorary Prize .103
War and discovery .391

SCIENTIFIC AMERICAN.
During and after the war .472
One of eleven .293

SEA-WEED FOR WAR .*231
SELENIUM .163
SEPARATION OF MATERIALS .202
SHAFTING, hollow, British .405
SHEAR, ELECTRIC ROTARY .*360
SHIPS. See MERCHANT MARINE, and WARSHIPS.
SHOE LEATHER TESTS .331
SHOVEL, WORLD'S LARGEST .*412
SMOKE CLOUDS, dissipating .*65
SMOKE consumption, successful .151
SMOKESTACK, FELLING A .*83
SMOKE, turning, into money .*50
SOAP-MAKING, ART OF .*230
SOAPS FROM GARBAGE PAIL .200
SOLDERING IRON temperature .*156
STARS. See ASTRONOMY.

STEEL.
Electric steel, high-grade .*51
Hardening, automatic .187
Quantitative spectrum analysis .437

STOKER, efficient underfeed .*256
STORMS. See METEOROLOGY.
STOVE that packs like suit case .*298

SUBMARINES. See WARSHIPS, and WAR, THE EUROPEAN.

SUGAR.
Beet, sugar extraction from .167
Fourteen pounds from ten .130
How Army saves sugar .163
Relative sweetness of sugars .312
Shortage, reasons for .225
Sorghum, sugar from .270
Substitute, sugar .91

SUN. See ASTRONOMY.

T

"TANKS." See AUTOMOBILES, and WAR, THE EUROPEAN.
TELEFERICA, THE .*46
TELEPHONES. See ELECTRICITY.
TEMPLE OF THE GODS, Utah .*267
TEST BY THE PERMEATOR .328

TEXTILES.
Land of the Ersatz .368
Paper yarn, Germany .426
Pine needles, textile from .368
Textile engineers of tomorrow .*232

TIME SIGNALS, new clock relay .*484
TIME, NEW DIVISIONS OF .*522
TIME, what is the .31
TIN needed in silk manufacture .405
TIN PLATE IN AUSTRALIA .127
TIN PLATE substitutes .27
TIN SCRAP and Germany .142
TOOLMAKING, Federal attention .147
TOOLS, straightening hardened .233
TORPEDO. See ORDNANCE AND ARMOR.
TRADE. See INDUSTRY AND TRADE.
TRADE MARKS. See INVENTION AND PATENTS.

TREES AND FORESTRY.
Finland and paper supply .411
Forest research, Tasmania .453
Forestry studies, Canada .284
Leaves, autumnal coloration .359
Saw, one-man .*172
Saw, portable gasoline drag .*194
Spruce, getting out airplane .*438
Wood, lightest known .247

TUNNEL, fighting gas in .147
Electric bulletins from typewriter .*442

U

UNICYCLE, speedy and safe .*416
UNIVERSITY AT CORK .147

V

VIRGIN ISLANDS.
Census .337
Agricultural research .337

VISE, even-pressure .*72
VISE STAND, PORTABLE .*360
VISE that fastens anywhere .*256

W

WARFARE. See also AERONAUTICS, NATIONAL DEFENSE, WARSHIPS, WAR, THE EUROPEAN, etc.
Armor, ancient, adapting .*149
Armor for soldiers .*233
Blasting bridges to hamper pursuit .*379
Gas in warfare .228
Hand armor for rifleman .*379
Our specialists in gas .136
Radio-operated steel soldier .289
Searchlight with ears .*379
Shotgun, military .49
Specialists, warfare of .84
Tank, wire-cutting .*169
Warfare by analogy .107

WARSHIPS. See also WAR, THE EUROPEAN, etc.
BATTLESHIPS.
Armament of destroyers .
British shipping losses .
Destroyer built, record time .
Destroyer gains and losses .
German fleet, surrender of .
Great Britain at war .
"Hush" ships of British navy .
Italy's contribution .
Jutland, battle of .
New York's two battleships .
"Queen Elizabeth" .
"San Diego," lesson of the .
Stolen battleships .
Warship to cargo vessel .
SUBMARINES.
Abolish the submarine .
Anti-submarine tactics .*25, 67, 103, *
Anti-U-boat fleet .
Anti-U-boat operations, French .
Depth bomb and patrol boat .
Duel between submarines .
German submarines .
Latest U-boats .
Safety zone for submarine .
U-boat off our coasts .
SUNDRY.
Destroyers, American .
First "Eagle" boat tested .
Sea tank, Italian .
Sinking of sub chaser .
Snapshots of German surrender .
U-boat chasers cross Atlantic .

WAR, THE EUROPEAN. See also AERONAUTICS, AUTOMOBILES, ORDNANCE AND ARMOR, WARSHIPS, etc.
After-war problems, Europe .
Allied propaganda, how spread .
Anti-U-boat operations .
Armies sail to battle, where .
Artillery which keeps pace with infantry .
Baedeker for military intelligence .
Broken idol .
Cableways, military .
Camouflage, gun .
Camouflage robes .
Casualties in the war .
Civilization vindicated .
Coal fields, Essen .
Coffee grinding by water power .
Destroyers, American .
End of the world war .
Food containers, gas-proof .
Football tactics, Western front .
Freedom of the seas .
Freedom through an empty barrel .
From trenches to open warfare .
Gases, battle of .
Gasoline, how Red Cross saves .
German army crumbling? .
German fleet, surrender of .
"Give them a start" .
Great Britain at war .
Great Britain pays the price .
Guns, German losses in .
Hindenburg's dilemma .
Horse ambulance, novel .
How guns and balloons hide .
Ignorance, battle against .
Jutland, battle of .
Kultur .350,
Lille, redemption of .
Majesty of the law .
Naval position of U. S .
No-decision war .
Odd ways of transporting wounded .
Optimism, conservative .
Optimism, warning against .
Peace and naval policy .
Peace by correspondence .
Pigeon express .
Poison gas in 1908 .
Potsdam and shotguns .
Queer defense systems .
"Restitution and reparation" .
Roads, camouflaged .
Ships, British, sunk in war .
Sky-rockets of night fighters .
Smoke screen of Paris .
Spain, if, went to war .
Spoils which go to victors .
Store, second-hand .
Strategic moves .*8, *48, *88, *126, *210, *250, *292, *334, *
Surrender, snapshots of German .
Tank, French lightweight .
Tank, secret of "baby" .
Tanks, tactics and .
Tanks, "whippet" .
Tanks, will, win the war? .
Trench warfare, oddities of .
Turkish defenses fail .
When the Hun comes to Paris .
Winning the war .
Zeebrugge, ships sunk at .

WASH BASIN, collapsible .*

WATER POWER AND SUPPLY.
Canada's new Niagara plant .
Drave River, harnessing .
Hydroelectric plant, automatic .
Meters, reading, at distance .
Pollution of boundary waters .

WEATHER. See METEOROLOGY.
WEIGHING A MOVING MASS .*
WELDING, ELECTRIC .
WINDOW, REFLECTLESS .*
WINDOWS, PAPER-TAPED .*
WIRE, AUTO REEL FOR .*

WIRELESS TELEGRAPHY.
Dutch long-distance .
Enemy in our midst .
Germany's 6,000-mile voice .
Holland and her colonies .
Instruments and measurements .
Japanese long-distance .
Powerful station, Argentine .
Proposed radio control .
Radio and the great war .
Wireless legislation .512,
Radio instruments, etc .
Wireless telegraphy and static .

WOMEN IN WAR WORK.
Electrical welders on ships .
Navvies, women .
Repairing soldiers' uniforms .
Women and labor shortage .
Women executives, new field .

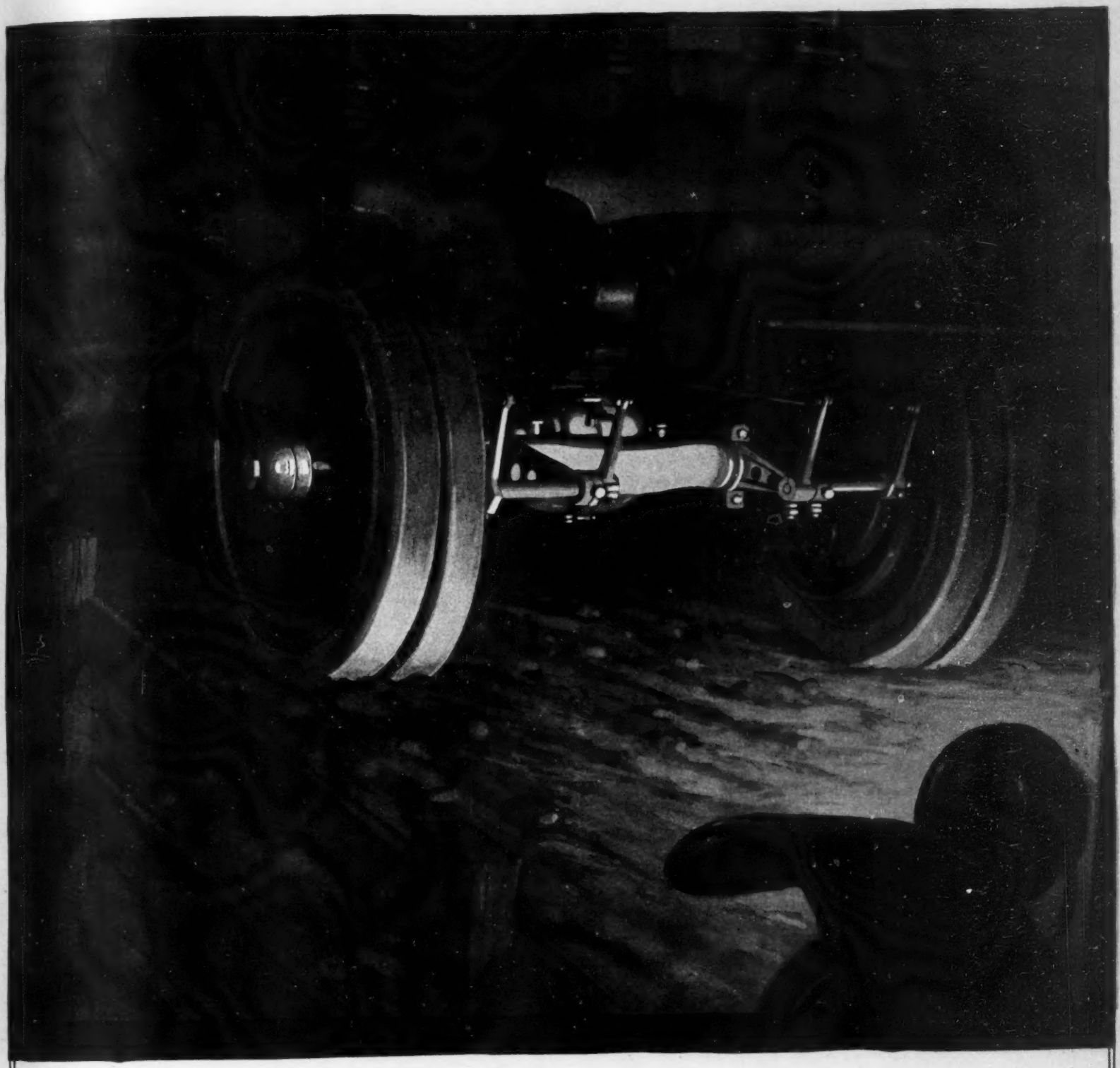
WOOD-SURFACING MACHINE .

X

X-RAYS.
Finding bullets .*
Metals, use of X-rays on .
Tube, lengthening life of X-ray .*
Tube, manufacture, war time .

Z

ZINC, new uses for .
ZINC SULFIDE .247,
ZUYDER ZEE, how Holland will dispose of .*



Makes Light of Heavy Work

Clark Axles and Wheels are strong

They are found only on good motor trucks

CLARK
Rear Axles · Steel Wheels · Locking Differentials
For Motor Trucks
EQUIPMENT

Informative literature mailed upon request

CLARK EQUIPMENT COMPANY
BUCHANAN — MICHIGAN

Special for Ford Commercial Cars
$12.00
Carried in stock by all jobbers

Do you know ... or guess ... delivery costs?

What were your truck costs last month—gas consumption, tire mileage, repair and labor costs per service mile? How did it compare with the previous month? Do you actually know or are you guessing at it?

Whether you have a fleet of trucks or one commercial car, you should know from day to day what deliveries are costing you. If your driver is making a good record, he wants you to know it. If he is making a poor record, you ought to know it.

Every turn of the wheel, forward and backward, daily, weekly and monthly, can be recorded in cumulative totals (up to 100,000 miles and repeat) by simply removing the front left hub cap and attaching a Johns-Manville Hub Odometer.

No flexible shaft, gears or brackets necessary. Simple, quick and reliable—no upkeep expense. Just an accurate summary of easy-to-read figures that enable you to take the guesswork out of delivery costs.

Made to fit all makes and models of cars. Write for our recording efficiency chart. It will be very helpful.

We guarantee the Johns-Manville Hub Odometer against defective material and workmanship and to be grease- and oil-proof for one year from date of sale.

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories — Branches in 63 Large Cities

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

Johns-Manville
HUB ODOMETER